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## ERRATA

NSA Vol. 9, No. 1, p. 26. In abstract 175, H. J. Grant should be N. J. Grant.

NSA Vol. 9, No. 6A, p. 235. In abstract 1793, Z. I. Dizdar should be Z. I. Dizdar.

NSA Vol. 9, No. 8, p. 378. In abstract 2932, V. I. Katarov should be V. I. Satarov.





## GENERAL

## 4658 TID-5059(2nd Rev.)

Technical Information Service, AEC.

CORPORATE AUTHOR ENTRIES USED BY THE TECHNICAL INFORMATION SERVICE IN CATALOGING REPORTS. (SECOND REVISED EDITION). Charlotte F[orgey] Chesnut, Alden G. Greene, and Emil Schafer, [comps]. Mar. 1955. 234p.

## ATOMIC BOMBS AND WARFARE

## 4659 FWE-19

Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

SYMPOSIUM ON THE PHYSICAL EFFECTS OF ATOMIC WEAPONS. PAPER NO. 14. THE BASE SURGE: THE MECHANISM OF FALL-OUT. E. P. Hicks and W. G. Penney. Sept. 24, 1954. Decl. May 17, 1955. 24p.

Calculations are presented on the mechanism of fall-out from the base surge following an atomic explosion. Factors affecting the mechanism of fall-out, the coagulation of fine droplets by Brownian motion, the growth of fine droplets by evaporation and condensation, the coagulation of droplets caused by differential falling velocities, and the probability of droplet coalescence are discussed. (C.H.)

## RESEARCH PROGRAMS

## 4660 CERN-55-2

European Organization for Nuclear Research, Geneva. THE SCOPE AND ACTIVITIES OF CERN, 1950-1954. Edoardo Amaldi. Jan. 7, 1955. 21p.

The organizational and legal development of CERN is summarized. The particle accelerators being designed for or at the disposal of CERN are described. Other activities of CERN include a Theoretical Study Group to provide advanced training for junior theoretical physicists, cooperative programs for research with high-energy particle accelerators and cosmic ray research, and research teams to study nuclear induction and cosmic ray problems. (M.P.G.)

## BIOLOGY AND MEDICINE

## 4661

EFFECTS OF ADRENAL HORMONES ON CAPILLARY PERMEABILITY IN PERFUSED RAT TISSUES. Eugene M. Renkin and Barbara D. Zaun (Brookhaven National Lab., Upton, N. Y.). *Am. J. Physiol.* 180, 498-502(1955) May.

Capillary permeability to fluid, protein and sucrose have been measured in the perfused hindquarters of normal and adrenalectomized rats by the methods of Pappenheimer et al. No differences between the two groups were observed, with or without addition of adrenal cortical extract. Aqueous adrenal cortical extract was found to contain a vasoconstrictor agent readily destroyed by oxidation in alkaline solution and

therefore presumed to be epinephrine. Reports by other investigators of decreased capillary permeability following injection of such extracts are attributed to the vasoconstriction. The permeability of the capillaries in perfused rat hindlegs to fluid, protein and sucrose are comparable in magnitude to, but significantly greater than the same quantities in the perfused hindlegs of cats. (auth)

## 4662

SELECTIVE UPTAKE OF  $Zn^{65}$  BY DORSOLATERAL PROSTATE OF RAT. S. A. Gunn, Thelma C. Gould, S. S. Ginori, and Jerome G. Morse (Univ. of Miami, Fla.). *Proc. Soc. Exptl. Biol. Med.* 88, 556-8(1955) Apr.

The dorsolateral prostate of the rat concentrates  $Zn^{65}$  from 15 to 25 times more than any other organ. These concentrations are high enough to suggest the use of this element in studies of the physiology of the prostate and possibly in the evaluation of clinical diseases of that organ. (auth)

## 4663

THE IN VIVO PARTITION OF MANGANESE AMONG SOME ORGANS AND INTRACELLULAR ORGANELS OF THE RAT. Laurence S. Maynard and George C. Cotzias (Brookhaven National Lab., Upton, N. Y.). *Trans. N. Y. Acad. Sci.* 17, 194(1955) Jan.

## RADIATION EFFECTS

## 4664 AMRL-167

Army Medical Research Lab., Fort Knox, Ky. THE RESPONSE OF NORMAL AND ADRENALALECTOMIZED RATS TO A MILD, SMALL AREA SKIN BURN. John A. Jacques, Roy Korson, Irven C. Graham, John A. Blair, Robert W. Narky Jr., and Hans F. Kuppenheim. Jan. 27, 1955. 13p.

The local inflammatory response to a restricted, mild skin burn is less and slower in onset in adrenalectomized rats than in normal rats. (auth)

## 4665 NP-5645

Chicago. Univ. Air Force Radiation Lab. QUARTERLY PROGRESS REPORT NO. 15. Apr. 15, 1955. 144p. Contract AF33(038)-27353.

Progress is reported in studies on the influence of x radiation, with and without shielding and combinations of nitrogen mustards, on rat hematopoietic system tissue weight, respiration, and enzyme activity; the protective effects of methyl bis(2-chlorethyl)-amine hydrochloride on tissues shielded during x irradiation; the effects of irradiation on the metabolism of borneols and phenols in rats; the effect of environmental temperature and barometric pressure at various altitudes on the lethality of whole-body x irradiation in rats; the influence of antipyretic analgesics on the survival time and mortality of irradiated mice; the effects of chlorpromazine on the survival time and weight loss of irradiated rats; and the effects of injections of various tissue homogenates on the survival of irradiated mice. (For preceding period see NP-5526.) (C.H.)



**4666 NYO-4919**

Western Reserve Univ., Cleveland. Atomic Energy Medical Research Project.

EFFECT OF SHORT INTERVAL FRACTIONATION ON THE LETHAL PROPERTIES OF TOTAL BODY RADIATION IN RATS. J. P. Storaasli, S. Rosenberg, J. S. Krohmer, and H. L. Friedell. Apr. 27, 1955. 25p. Contract W-31-109-Eng-78.

**4667 NYO-4920**

Western Reserve Univ., Cleveland. Atomic Energy Medical Research Project.

THE REVERSAL BY HIGH OXYGEN TENSION OF THE PROTECTIVE ACTION OF CYSTEINE IN IRRADIATED RATS. Paul R. Salerno and Hymer L. Friedell. Apr. 27, 1955. 25p. Contract W-31-109-Eng-78.

**4668 USNRDL-TR-37**

Naval Radiological Defense Lab., San Francisco.

THE EFFECT OF WHOLE-BODY X IRRADIATION OF MICE ON IMMUNITY TO TETANUS TOXOID. PART I. THE EFFECTIVENESS OF PRE- AND POST-IRRADIATION INJECTIONS OF TETANUS TOXOID WITH RESPECT TO THE DEVELOPMENT OF IMMUNITY. M. S. Silverman and P. H. Chin. Mar. 3, 1955. 18p.

Serological determination of x-irradiation-inhibited antibodies does not necessarily indicate the immune state. In this study immunity is directly challenged by injection of tetanus toxoid into mice at various times before and after x irradiation. Fourteen days after injection immunity was measured by injection of 10 MLD of tetanus toxin. Observation for paralysis and death was for one week. Inhibition by x irradiation of the immune response to tetanus toxoid is a function of irradiation dose and of time of immunization in relation to the time of irradiation. The higher the dose, the greater the inhibition. Post-antigen is as effective as pre-antigen irradiation in injuring the immunity mechanism. The amount of injury depends on the irradiation dose. The closer to the time of irradiation that the toxoid is administered, the greater is the inhibition of immunity. (auth)

**4669**

OCULAR EFFECTS PRODUCED BY HIGH-INTENSITY X-RADIATION. Paul A. Cibis, Werner K. Noell, and Bertram Eichel (U.S.A.F. School of Aviation Medicine, Randolph Field, Tex.). *Arch Ophthalmol.* 53, 651-63(1955) May.

Results are summarized from an investigation of the effects of high-intensity ionizing radiation upon the eye of albinotic and pigmented guinea pigs, rabbits, rhesus monkeys, and dogs. (C.H.)

**4670**

INCREASED RADIATION SENSITIVITY OF PERTUSSIS VACCINATED MICE. M. Rowen, W. S. Moos, and M. Samter (Univ. Of Illinois Coll. of Medicine, Chicago). *Proc. Soc. Exptl. Biol. Med.* 88, 548-50(1955) Apr.

**4671**

INDUCED POLLEN LETHALS FROM SEEDS OF DATURA STRAMONIUM EXPOSED TO DIFFERENT RADIATIONS. J. L. Spencer and A. F. Blakeslee (Federal Experiment Station, Mayaguez, Puerto Rico, and Smith Coll. Genetics Experiment Station, Northampton, Mass.). *Proc. Natl. Acad. Sci. U. S.* 41, 307-12(1955) May.

Analysis of pollen lethals evident in Datura plants developing from seeds exposed to radiations clearly demonstrates a marked difference for the relative biological efficiencies

of fast neutrons from a nuclear detonation, fast neutrons from a cyclotron, and x radiation. Data are tabulated. (C. H.)

**4672**

THE ROLE OF OXYGEN AND PEROXIDE IN THE PRODUCTION OF RADIATION DAMAGE IN PARAMECIUM. R. F. Kimball (Oak Ridge National Lab., Tenn.). *Ann. N. Y. Acad. Sci.* 59, 638-47(1955) Feb.

It can be shown that the effect of reduced oxygen tension in lowering the x ray-induced mutation rate in *Paramecium aurelia* cannot be attributed to a decreased production of  $H_2O_2$ , since this substance is ineffective as a mutagen either by itself or in combination with x rays. This effect could mean that the oxygen-dependent part of the mutagenic effect is brought about by short-lived radicals acting as mutagens; but it is emphasized that a diffusible chemical mutagen interpretation is by no means required even if, as seems probable, oxygen takes part in the chemical reactions immediately following the absorption of the energy of the radiation. Comparison of the role of oxygen in the production of various kinds of radiation damage to *Paramecium* and a brief review of the work of others on bacteriophage, DNA, and protein strongly suggests that oxygen may play a variety of roles, and that there are no real grounds for expecting uniformity in different biological materials. (auth)

**4673**

EFFECTS IN DOGS OF LARGE DOSES OF INTRAPERITONEALLY ADMINISTERED RADIOACTIVE COLLOIDAL GOLD ( $Au^{199}$ ). Andrew H. Jackson and P. F. Hahn (Meharry Medical Coll., Nashville, Tenn.). *Cancer* 8, 482-7(1955) May-June.

Clinical observation and hematological changes are presented on nine dogs receiving one to four intraperitoneal injections of radioactive colloidal gold. Histological changes in seven of these animals are described. A mean group weight loss of 14.1 per cent occurred. Peritoneal effusion occurred in eight of the nine animals following gold injection; however, no cases of adhesions or radiation ulcer were seen. Adjacent organ changes were not remarkable. An omental reaction to the injected substance was noted. Dogs receiving multiple injections suffered varying degrees of bone-marrow hypoplasia and anemia. (auth)

**4674**

THE EFFECTS OF RADIATION IN VITRO ON OXIDATIVE PHOSPHORYLATION AND ADENOSINE TRIPHOSPHATASE. Margery G. Ord and L. A. Stocken (Univ. of Oxford). *Brit. J. Radiol.* 28, 279-82(1955) May.

**4675**

RADIOSENSITIVITY WITH RESPECT TO THE ESTROUS CYCLE IN THE MOUSE. Roberts Rugh and Helen Clugston (Columbia Univ., New York). *Radiation Research* 2, 227-36 (1955) May.

Male  $CF_1$  mice are more radiosensitive than are females of the same strain, regardless of the phase of the estrous cycle in which the females are x-irradiated. Female  $CF_1$  mice, if x-irradiated during any of the three major phases of the estrous cycle, are not equally radiosensitive. Those in estrus are the most radioresistant; those in diestrus the most radiosensitive. This was demonstrated in three experiments involving 447 females. In every experiment the mice x-irradiated during estrus showed the best and those in diestrus the poorest survival values. Since females in pre- and post-estrus were classified and x-irradiated together, it



is not possible to distinguish between the two groups in regard to survival value. However, the fact that this combined stage was the least consistent suggests that possibly one might well prove to be the most radioresistant of all stages, by virtue of its high estrogen production. It is postulated that the hypersecretion of estrogens during estrus, plus possibly the correlated endocrine and hydration changes, may be the cause of increased radioresistance during this phase in CF<sub>1</sub> female mice. (auth)

#### 4676

ORGAN WEIGHT ANALYSIS IN MICE GIVEN FRACTIONATED X-IRRADIATION. A. N. Stroud, J. M. Gurian, A. M. Brues, and M. M. Summers. (Argonne National Lab., Lemont, Ill.). Radiation Research 2, 267-79(1955) May.

Female CF-1 mice 7 to 9 weeks of age were given various dosages of total-body x ray at weekly intervals for 6 weeks, the accumulated total dosages falling between 400 and 1200 r. One week after the last exposure they were sacrificed, and the organs were weighed. Organ weights have been corrected for changes in total body weight. No relative change in weight occurred in the kidneys, heart, or adrenals. Muscle and liver showed a slight relative increase. Thymus, uteri, and ovaries showed an approximately exponential loss of weight with increasing dose. The spleen showed an atypical weight response, decreasing at the lower dosages and then returning to control values in the range from 600 to 1200 r total accumulated dose. Calculation from sections and weights of the absolute volumes of the several splenic tissue components showed that white pulp and inactive red pulp behaved like the other radiosensitive organs, but active red pulp increased with the total dosage, thus accounting for the net increase in splenic weight at the higher dose levels. Examination of spleens during the irradiation period shows that the weight does not decrease constantly with repeated irradiation, but that two phases of recovery take place, the second in the week after the sixth dose. The thymus shows similar behavior but fails to show the overcompensation displayed by the spleen. (auth)

#### 4677

THE REACTION OF THE MOUSE THYMUS TO X-RAYS MEASURED BY CHANGES IN ORGAN WEIGHT. Robert F. Kallman and Henry I. Kohn (Univ. of California School of Medicine, San Francisco). Radiation Research 2, 280-93 (1955) May.

In normal, nonirradiated CAF<sub>1</sub> mice, the weight of the thymus increased until the animals were approximately 45 days old when age involution began. Involution ceased at 80 to 90 days of age. With female mice 50 to 60 days old, the acute involution of the thymus after total-body exposure to 250-kv constant potential x rays was measured by changes in organ weight. Twenty-four hours of fixation in 10% formalin increased thymic weight by 20 to 40%, depending on the strain of mice, CAF<sub>1</sub> or A/He. Dose-effect analyses of the weights of either fresh or fixed, wet or dry thymuses, however, yielded qualitatively similar results. Thymic weight was reduced as much as one-fourth by handling the mice preparatory to irradiation. Decreased food consumption per se could account for half the thymic weight loss after 400 r, total-body irradiation. The time for maximum weight loss to occur varied from 1 day for a dose of 30 r to 5 days for 800 r. Weight determined at 5 days after total-body irradiation was a linear function of the logarithm of radiation dose but was not a true measure of radiation injury, since some recovery had occurred at doses below

400 r. There was no significant difference in percentage weight loss per roentgen in the CAF<sub>1</sub> and A/He strains tested in this Laboratory. The dose for 50% weight loss was 150 r, significantly lower than 210 r for the Carworth Farms strain reported from Los Alamos. Minimum post-irradiation thymic weight was a curvilinear function of radiation dose. The interpretation of the curve was difficult, since total-body irradiation caused loss indirectly due to injury in other organs as well as directly. The dose for 50% loss was 90 r. The data were considered in terms of different dose-effect models. The best fitting equation was one which assumed that the thymus was composed of two independently reacting populations with different sensitivities. (auth)

### RADIATION HAZARDS AND PROTECTION

#### 4678

STUDIES ON THE MECHANISM OF RADIATION PROTECTIONS AND RECOVERY WITH CYSTEAMINE AND  $\beta$ -MERCAPTOETHANOL. Alexander Hollaender and C. O. Doudney (Oak Ridge National Lab., Tenn.). Pages 112-15 of Radiobiology Symposium (Proceedings) 1954. Z. M. Bacq and P. Alexander, eds. London, Butterworths Scientific Publications, 1954.

Results are reported from a comparison of the protection efficiency of cysteamine and  $\beta$ -mercaptoethanol against radiation injury and recovery of E. coli. (C.H.)

### RADIOGRAPHY

#### 4679 AMRL-180

Army Medical Research Lab., Fort Knox, Ky. TECHNICAL RADIOGRAPHY WITH BETA-EMITTING ISOTOPES. J. G. Kereiakes and A. T. Krebs. Mar. 21, 1955. 14p.

X radiation produced by a pure beta emitter, Sr<sup>90</sup>-Y<sup>90</sup> Medical Applicator (characteristic x-radiation, internal and external bremsstrahlung produced in the source and its encapsulation), can be used in technical and industrial radiography. The radiographs of various objects show rather good definition and contrast in spite of unfavorable focal spot size (5 mm source active diameter) and low source strength (about 300 mc). The radiographs compare favorably with radiographs using  $\gamma$ -emitting isotopes such as thulium<sup>170</sup> and iridium<sup>192</sup>. (auth)

### RADIOTHERAPY

#### 4680

FOLLOW-UP STUDY OF ONE HUNDRED CASES OF CARCINOMA OF THE PROSTATE TREATED WITH RADIOACTIVE GOLD. H. Dabney Kerr, R. H. Flocks, H. B. Elkins, David Culp, and T. C. Evans (State Univ. of Iowa Coll. of Medicine, Iowa City). Radiology 64, 637-41(1955) May.

One hundred cases of Group II carcinoma of the prostate treated by interstitial radiation with radioactive gold inserted through a retropubic incision were followed from fifteen to twenty-seven months and were studied again one year later. Fifty-two additional cases have been followed for a minimum of one year and a maximum of two years. A study of these cases indicates that rectal complications can be eliminated by careful usage of the radioactive material, with only one significant complication remaining, i.e., calculus formation in the sloughing tissue. Experience indicates, also, that it is practically impossible to sterilize



any except the smallest of neoplasms with radioactive material alone. Time and method of surgical removal and of additional injection are individualized for each patient. Subsequent perineal injections must be done for residual neoplastic masses. Of the first 100 patients followed from twenty-four to thirty-nine months (to June 1, 1954), 46 were alive, 18 with disease, and 28 without disease; 54 were dead. That is, 28 per cent had no clinical evidence of neoplasm over a period of observation of at least twenty-four months. At least 13 died of causes other than carcinoma. Since all of these patients would eventually die of cancer if treated palliatively, it seems worth while to continue this method in an effort to save some. (auth)

#### 4681

AN EVALUATION OF THE GLAND DEPTH ERROR IN MEASURING THE THYROID UPTAKE OF RADIOIODINE. Howard L. DeMorest and Sol Sandhaus (Veterans Administration Hosp., Minneapolis, Minn.). Radiology 64, 701-3 (1955) May.

It appears that the method involving an average gland depth, which is in general use, is to be preferred for the following reasons: (a) The accuracy is equivalent to that for the calculated depth method. (b) The total time for the uptake test and the required mathematical calculations are reduced to a minimum. (auth)

#### 4682

TREATMENT OF PERITONEAL MESOTHELIOMA WITH RADIOACTIVE COLLOIDAL GOLD. REPORT OF A CASE. Raymond G. Rose, John D. Palmer, and Marvin N. Loughheed (Montreal General Hospital and McGill Univ., Montreal, Quebec, Canada). Cancer 8, 478-81 (1955) May-June.

A case is described of a patient with peritoneal mesothelioma successfully treated with radioactive colloidal gold. Prior to this therapy the patient required a total of 250 paracenteses at intervals of four to seven days. Following therapy, the fluid accumulation ceased, and eighteen months have now elapsed since the last paracentesis. The properties of radioactive gold and its clinical applications are reviewed along with a discussion of the probable mechanism responsible for the cessation of fluid formation. Radioactive gold is considered to be the most satisfactory therapy available for treating this condition. (auth)

#### 4683

PATHOLOGICAL STUDY OF EIGHT PATIENTS WITH GLIOBLASTOMA MULTIFORME TREATED BY NEUTRON CAPTURE THERAPY USING BORON 10. John T. Godwin, Lee E. Farr, William H. Sweet, and James S. Robertson (Brookhaven National Lab., Upton, N. Y.). Cancer 8, 601-15 (1955) May-June.

A pathological study of the effects of neutron-capture therapy employing boron 10 has been recorded in eight patients. Of these, three patients given multiple irradiations revealed changes in the tumor that were suggestive of irradiation effects. Large areas of viable tumor were found in all cases. At the present time it is not possible to ascertain the dose of irradiation attributable to the boron slow-neutron process. Therefore it is not possible to be certain that irradiation of an order expected to produce significant histological changes was delivered to the tumor. Irradiation effects were present in the scalp of several patients, although material for adequate pathological study was obtained from only one. More recently, the scalp of another patient, not included in this report, from which adequate material was obtained revealed similar alterations. The distribution of thorotrast was dem-

onstrated radioautographically in two cases in which it had been employed for arteriography. (auth)

#### 4684

THE PERFORMANCE OF THE MEDICAL RESEARCH COUNCIL 8 MEV LINEAR ACCELERATOR. G. R. Newbery and D. K. Bewley (Hammersmith Hosp., London). Brit. J. Radiol. 28, 241-51 (1955) May.

The 8-Mev linear accelerator of the Medical Research Council, which is installed at Hammersmith Hospital, London, is described. An account is given of the physical measurements which have been made to enable the best use to be made of the machine for x-ray therapy. These measurements include work on protection, beam flattening, output calibration and isodose curves. The machine normally gives a stabilized dose-rate of 100 rads/min at 2 cm deep in a water phantom with its surface at 1 m from the target. Four hundred patients were treated between September 1953 and December 1954. A report is made on the operation of the machine, which has been very satisfactory. (auth)

#### 4685

RADIOIODINE UPTAKE IN THYROID CARCINOMATA. R. M. Cunningham, Gwen Hilton, and E. E. Pochin (Univ. Coll. Hospital Medical School, London). Brit. J. Radiol. 28, 252-6 (1955) May.

Measurements are described which have proven useful in evaluating the response of thyroid carcinoma to successive doses of radioiodine. (C. H.)

#### 4686

MEDICINA NUCLEARE. INTRODUZIONE ALLE APPLICAZIONI MEDICO-BIOLOGICHE DELLA FISICA NUCLEARE. (Nuclear Medicine. Introduction to Medical-Biological Applications of Nuclear Physics). Aldo Perussia, U. Facchini, E. Gatti, L. Malatesta, C. Salvetti, and M. Silvestri. Rome, Il Pensiero Scientifico Editore, 1954. 877p. Lire 7000. (\$13.50) (In Italian)

Fundamental information on the medical applications of nuclear energy and techniques for the application of radioisotopes as tracers in biological and medical studies and in therapy are reviewed. 110 references. (C.H.)

#### TOXICOLOGY STUDIES

##### 4687 AEC-tr-2129

MAXIMUM ALLOWABLE CONCENTRATES OF POISONOUS GASES, VAPORS, AND DUSTS IN THE AIR SPACES OCCUPIED BY WORKERS AT USSR INDUSTRIAL ESTABLISHMENTS. Translated from Spravochnik Khimika (Book), Vol. III, 1952, 1172-3.

##### 4688

RADIATION HAZARDS IN THE USE OF THORIUM X FOR SKIN THERAPY. S. J. Wyard, A. Nightingale, and I. G. Austin (Guy's Hospital Medical School, London). Brit. J. Radiol. 28, 274-8 (1955) May.

An investigation has been made of the radiation hazards to staff and patients from the use of Ra<sup>224</sup> in skin therapy. Particular attention has been paid to the effects of the liberation of thoron gas into the atmosphere and to the effects of the penetration of the patient's skin by the radioactive material. It is concluded that, provided reasonable precautions are taken, the dangers to both staff and patients are small. (auth)

##### 4689

DISTRIBUTION, RETENTION, AND ELIMINATION OF Be<sup>7</sup> IN THE RAT AFTER INTRATRACHEAL INJECTION. C. D.



Van Cleave and C. T. Kaylor (Univ. of North Carolina School of Medicine, Chapel Hill). *Arch. Ind. Health* **11**, 375-92 (1955) May.

#### TRACER APPLICATIONS

##### 4690 AMRL-174

Army Medical Research Lab., Fort Knox, Ky.  
EFFECT OF THYROTROP IN ADMINISTRATION ON THE IN VITRO UPTAKE AND CONVERSION OF  $I^{131}$  AND RELEASE OF ORGANIC-BOUND  $I^{131}$  BY THE ISOLATED THYROID GLAND. C. D. Eskelson, H. E. Firschein, and H. Jensen. Jan. 30, 1955. 8p.

Administration of TSH to rats was found to induce a lowering of the in vitro  $I^{131}$  concentration and conversion by the isolated thyroid gland. This response to TSH administration has been related to an increase in the thyroid hormone blood level. (auth)

##### 4691 NYO-4918

Western Reserve Univ., Cleveland. Atomic Energy Medical Research Project.

INCORPORATION OF OROTIC ACID- $2-C^{14}$  AND CYTIDINE- $C^{14}$  INTO NUCLEIC ACIDS OF NORMAL AND IRRADIATED CHICK EMBRYOS. Paul S. Lavik. Apr. 22, 1955. 15p.

Contract W-31-109-eng-78.

Orotic acid- $2-C^{14}$  was injected into embryonated eggs on their 11th day of incubation, and the specific activities of the DNA and RNA pyrimidines in the embryos were determined 48 hours later. The same procedure was followed in another set of embryos using cytidine labeled with  $C^{14}$  in the cytosine moiety. The polynucleotide pyrimidines isolated from the cytidine- $C^{14}$  injected embryos were more heavily labeled than in the orotate- $C^{14}$  treated embryos, particularly in the case of the DNA pyrimidines. To determine the effect of non-lethal dose of ionizing radiation on the incorporation of these precursors, 450 r x-irradiation was administered to one-half of the eggs 30 minutes or less before the precursor injection. The irradiated embryos contained more isotope in the RNA and DNA pyrimidines than did the controls in the orotic acid- $2-C^{14}$  experiment. In the cytidine- $C^{14}$  experiment, the RNA pyrimidines also contained more isotope in the irradiated embryos, but the DNA pyrimidines in the irradiated embryos were only about one-half as active as those in the control embryos. (auth)

##### 4692 UR-382

Rochester, N. Y. Univ. Atomic Energy Project.  
THE RELATIONSHIP OF THE CELL SURFACE TO ELECTROLYTE METABOLISM IN YEAST. Aser Rothstein. Feb. 9, 1955. 72p. Contract W-7401-eng-49.

In yeast the metabolism of electrolytes is closely associated with the metabolism of extracellular substrates, particularly glucose. The ability of the cell to bind and to transport ions and the effects of ions on the metabolism of the cells are reviewed. In each case the cell surface is intimately involved. The surface of the cell contains two species of fixed anionic groups, polyphosphates and carboxyl, capable of binding cations. Bivalent cations are bound much more firmly than monovalent. The anionic sites are involved in sugar uptake because when they are associated with heavy metal cations, a complete blockage of sugar uptake occurs. A second compartment of the cell surface apparently underlies that containing the ion binding sites. Into it  $K^+$  and  $H^+$  from the medium can pass by an exchange reaction, and can influence the glycolytic reac-

tions occurring there. The glycolytic reactions in turn can produce  $H^+$  ions and can also provide energy to transport  $K^+$  through the permeability barrier into the interior of the cell. Some speculations are presented concerning the mechanisms of ion transport not only for  $K^+$  but for bivalent cations and for phosphate as well. (auth)

##### 4693

INFLUENCE OF CHELATES ON THE METABOLISM OF RADIOYTTTRIUM (Y-90). H. C. Dudley (U. S. Naval Hospital, St. Albans, N. Y. and Brookhaven National Lab., Upton, N. Y.). *J. Lab. Clin. Med.* **45**, 792-9(1955) May.

A study of the influence of various chelating agents on the metabolism of yttrium (as  $Y^{90}$ ; half life 61 hours; 2.2-Mev beta) has shown that by selection of the proper reagent one may promote preferential deposition in selected tissue within 48 hours. Yttrium complexed with citrate, ED-di-ol, or NTA deposited in the liver, spleen, and bone marrow of rabbits. Complexed with an excess of EDTA, EG-di-ol, or ED-ol, the yttrium is preferentially deposited in bone, with ED-ol giving the highest bone/soft tissue ratios. Yttrium complexed with a minimum quantity of ED-ol is markedly concentrated in the wall of the stomach. Radio yttrium ( $Y^{90}$ ), administered intravenously as the chelate, is suggested as a means of delivering ionizing radiation of high energy to selected tissues, particularly to bone and stomach. (auth)

##### 4694

THE ACCUMULATION OF RADIOACTIVE IODINE BY HUMAN FETAL THYROID. Robert E. Hodges, Titus C. Evans, James T. Bradbury, and William C. Keettel (State Univ. of Iowa, Iowa City). *J. Clin. Endocrinol. and Metabolism* **15**, 661-7(1955) June.

##### 4695

UPTAKE OF RADIOACTIVE SULFATE BY ELEMENTS OF THE BLOOD AND THE BONE MARROW OF RATS. T. T. Odell, Jr., F. G. Tausche, and W. D. Gude (Oak Ridge National Lab., Tenn). *Am. J. Physiol.* **180**, 491-4(1955) Mar.

The in vivo uptake of  $S^{35}$ -labeled sulfate by platelets, megakaryocytes, and myeloid elements of the bone marrow of rats has been demonstrated. The results provide additional indirect evidence of the origin of platelets from megakaryocytes, and they also indicate a platelet life span of about 4 days. (auth)

##### 4696

RADIOISOTOPE STUDIES IN NEUROMUSCULAR DISEASE. 2. STUDIES IN MUSCULAR DYSTROPHY AND MYOTONIA DYSTROPHICA WITH SODIUM $^{22}$  AND POTASSIUM $^{42}$ .

William H. Blahd, Franz K. Bauer, Raymond L. Libby, and Augustus S. Rose (Wadsworth General Hospital, Veterans Administration Center, Los Angeles and Univ. of Calif., Los Angeles). *Neurology* **5**, 201-7(1955) Mar.

If results are reported from measurements of total exchangeable sodium and potassium by the isotope dilution method (utilizing radioactive sodium $^{22}$  and potassium $^{42}$ ) performed in patients with muscular dystrophy and myotonia dystrophica and family members. (auth)

## CHEMISTRY

##### 4697 MCC-1023-TR-104

Pennsylvania. Univ., Philadelphia.  
SYNTHESIS AND CHEMICAL PROPERTIES OF CERTAIN PHOSPHINOBORANES (thesis). David Milton Gardner.



Feb. 1955. 71p. [For Olin Mathieson Chemical Corp. Contract NOa(s)52-1023-c].

The syntheses and chemical properties of the phosphino-boranes derived from boron trichloride, dibutylboron chloride, and butylboron dichloride are reported. The polymerization of the phosphinoboranes is discussed; a reaction mechanism is suggested for the synthesis. Several reactions between boron trichloride and inorganic compounds are noted. (C.W.H.)

**4698** MCC-1023-TR-116

Pennsylvania. Univ., Philadelphia.

STUDIES ON THE BORON HALIDES AND THEIR ADDITION COMPOUNDS IN NONAQUEOUS SYSTEMS (thesis). Malcolm C. Henry. Feb. 1955. 153p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

The chemical and electrochemical properties of boron tribromide and its addition compounds in nonaqueous media are reported. (C.W.H.)

**4699** MCC-1023-TR-119

Rensselaer Polytechnic Inst., Troy, N. Y. Walker Lab.

STUDIES ON THE EXPLOSIVE OXIDATION OF PENTABORANE. SUMMARY REPORT. Harry C. Baden, Stephen E. Wiberley, and Walter H. Bauer. Feb. 1, 1955. 87p. [For Olin Mathieson Chemical Corp. Contract NOa(s) 52-1023-c].

The lower-composition explosive limits for the oxygen-pentaborane mixtures were determined at 15°C and varying pressures. The effects of the addition of diborane, carbon monoxide, iron pentacarbonyl, or nitrogen on the explosive limits of the reaction mixtures were noted. A chain mechanism for the explosive oxidation of pentaborane is suggested. (C.W.H.)

**4700** MCC-1023-TR-121

Syracuse Univ., N. Y.

VAPOR PRESSURES AND DIELECTRIC CONSTANTS OF DIBORANE AND PENTABORANE. FINAL REPORT.

Henry E. Wirth and Emiel D. Palmer. Feb. 1955. 45p. [For Olin Mathieson Chemical Corp. Contract NOa(s)52-1023-c].

The vapor pressures of diborane were determined for the temperature range 108 to 181°K. The calculated value of the heat of vaporization of diborane is 3,413 cal/mole. The vapor pressures of pentaborane were determined for the range 226 to 298°K. The calculated heat of vaporization is 7,220 cal/mole. Diborane was found to be nonpolar while pentaborane is highly polar. Phase studies are reported for solid pentaborane. (C.W.H.)

**4701** NAA-SR-1203

North American Aviation, Inc., Downey, Calif.

CHEMISTRY OF THE PYROLYSIS OF p-TERPHENYL.

Louis Silverman, Katherine Trego, Mary Shideler, and William Houk. May 15, 1955. 28p. Contract AT-11-1-GEN-8.

The products obtained by heating p-terphenyl are described. The effects of temperature and of temperature-time were observed and co-related to the products formed. The trend of the reaction was postulated from the analytical results. (auth)

**4702** NRL-Memo-424

Naval Research Lab., Washington, D. C.

THE SOLUBILITY OF IMPURITIES IN METALLIC SODIUM.

D. D. Williams, J. A. Grand, and R. R. Miller. Feb. 1, 1955. 22p.

The solubilities of NaH and Na<sub>2</sub>CO<sub>3</sub> in metallic Na were determined for temperature ranges of 240 to 255°C and 150 to 385°C, respectively. The solubility of NaCl in metallic Na at 400°C was approximated. (auth)

**4703** ORNL-1882

Oak Ridge National Lab., Tenn.

THE USE OF RADIOACTIVE CARBON IN A STUDY OF 3-PHENYLCYCLOHEXYL AND RELATED SYSTEMS.

Howard J. Schaeffer. May 5, 1955. 59p. Contract W-7405-eng-26.

The dehydration of the cis- and trans-isomers of 2-phenylcyclohexanol-2-C<sup>14</sup> with phosphoric acid has been carried out. Isomerization was noted in the dehydration products which were analyzed by radiochemical techniques. The mechanisms of the dehydration and isomerization are discussed. (C.W.H.)

**4704** UCRL-2888

California. Univ., Berkeley. Radiation Lab.

HIGH-TEMPERATURE STUDIES: I. REACTIONS OF THE REFRACTORY SILICIDES WITH CARBON AND WITH NITROGEN. II. THERMODYNAMIC PROPERTIES OF THE CARBIDES. III. HEAT OF FORMATION OF THE <sup>3</sup>π<sub>u</sub> STATE OF C<sub>2</sub> FROM GRAPHITE (thesis). Oscar Harold Krikorian. Apr. 1955. 150p. Contract W-7405-Eng-48.

The reactions of silicides of Ti, Zr, Ce, Nb, Ta, Mo, and W with carbon and with nitrogen were studied at temperatures around 2000°K. The data were used to establish ternary phase diagrams and to set upper and lower limits on the heats of formation of the silicides. Methods are suggested for estimating absolute entropies of carbides. The heat of formation of the <sup>3</sup>π<sub>u</sub> state of C<sub>2</sub> has been determined as 191.4 ± 5 kcal at 0°K. (auth)

**4705** UCRL-2932

California. Univ., Berkeley. Radiation Lab.

CHEMISTRY DIVISION QUARTERLY REPORT [FOR]

DECEMBER 1954, JANUARY, FEBRUARY 1955. Mar. 30, 1955. 79p. Contract W-7405-eng-48.

The respiratory C<sup>14</sup> pattern was determined and correlated with physiological state in a human and equipment and results are described. Data are presented from studies on the respiratory C<sup>14</sup> patterns in normal and starved rats; tracer studies on adenine metabolism in rats; the synthesis and radiation decomposition of thioctic acid; the preparation of 6-methylmorphine; improved equipment for use in electron irradiations; the effects of ionizing radiation on choline chloride; the radiation chemistry of methionine; the photosynthetic formation of amino acids from formaldehyde and potassium nitrate; the alkaline hydrolysis of trifluoroacetyl amino acids; the demonstration of carboxy-dismutase in plant cells; and the preparation of ribulose diphosphate. Tracer studies were made on the role of C in the growth of proteins in plants. A scintillation counter for counting C<sup>14</sup> activity on paper chromatograms was designed. A study was made of the ternary system toluene-n-propyl alcohol-water as a scintillation solvent. The efficiency of mylar film windows as covering for large-window Geiger tubes was studied. Cross sections and excitation functions are given for reactions of Pu<sup>239</sup>, Pu<sup>238</sup>, U<sup>233</sup>, U<sup>235</sup>, Am<sup>241</sup>, Ta, and U<sup>238</sup> with alpha particles and reactions of Pu<sup>239</sup> and Pu<sup>240</sup> with deuterons. Some decay characteristics of 100<sup>254</sup>, 99<sup>253</sup>, Cf<sup>250</sup>, Cf<sup>252</sup>, Cf<sup>249</sup>, Cm<sup>245</sup>, Cm<sup>244</sup>, Cm<sup>243</sup>, Th<sup>230</sup>, Po<sup>209</sup>, and Po<sup>208</sup> are presented. Spectroscopic studies of the low-energy conversion spectra in Am<sup>241</sup>, Cm<sup>243</sup>, and Cm<sup>242</sup> are outlined. A correlation of



alpha decay energies with alpha half lives by means of a generalized Gamow relationship has been obtained. The inward numerical integrations have been completed for  $\text{Cm}^{242}$  and  $\text{Th}^{232}$ . A delay curve of the alpha-gamma coincidences in the alpha decay of  $\text{Cm}^{243}$  was made using the modified fast-coincidence counting apparatus. The mass-spectrometer appearance potentials of several ions found by the bombardment of diisopropyl ether with electrons have been measured. Equilibria studies were continued on the rare earth fluorides. Attempts were made to detect solvated electrons formed in the electron bombardment of liquid ammonia. A positive shut-off valve has been developed for mass spectrometers. Studies were continued on the alpha-track counter and the point field emission positive-ion-sources. Oxygen exchange studies of  $\text{UO}_2$ - $\text{ThO}_2$  systems have been carried out. The formula  $\text{MoO}_3\text{OHCl}$  has been established for the stable gaseous molecule in the  $\text{Mo-O-H-Cl}$  system. Further studies were made on the fluoride complexing of  $\text{Sn}^{2+}$ . The rate of the reaction between  $\text{Fe}^{3+}$  and  $\text{SCN}^-$  has been measured. The reaction between  $\text{RuO}_4$  and  $\text{H}_2\text{O}_2$  is discussed. (For preceding period see UCRL-2841.) (C.H.)

#### 4706 WADC-TR-53-325

Ohio State Univ. Research Foundation, Columbus.  
[PHENOMENA OF COMBUSTION AT HIGH PRESSURES].  
EFFECT OF BURNER-TIP TEMPERATURE ON FLASH-BACK OF HYDROGEN-OXYGEN FLAMES. Loren E. Bollinger and Rudolph Edse. Oct. 1953. 101p. Contract AF 33(616)-44.

In earlier experiments, it had been found that the flash-back tendency of hydrogen-oxygen flames is greatly reduced when the burner is water-cooled. The present work was undertaken to obtain more information about this fact by studying the relationship in turbulent flow between burner tip temperature and velocity gradient at flash-back, and to obtain data on the effects of the material, inside diameter, wall thickness and convergence of the burner tip. In this work the burner tip temperature always increased as flash-back was approached. The relationship between burner tip temperature and velocity gradient at flash-back is quite complex. Whereas the tip temperature was found to be practically independent of the inside diameter, with one unexplained exception, both the tip temperature and the velocity gradient were higher for burners of lower thermal conductivity. However, for burners with thinner walls the tip temperature was higher while the velocity gradient was lower. Also, a burner located in open air showed a higher temperature at flash-back and a lower velocity gradient than the same burner with restricted ventilation, which is interpreted to mean that the conditions prevailing in the gases surrounding the burner have a significant effect on the relationship between the burner's tip temperature and the critical velocity gradient. (auth)

#### 4707 WADC-TR-54-264

Monomer-Polymer, Inc., Chicago.  
[RUBBER, PLASTIC AND COMPOSITE MATERIALS].  
SYNTHESIS OF MONOMERIC MATERIALS. B. David Halpern, Wolf Karo, Leonard Laskin, Philip Levine, and Jack Zomlefer. Dec. 1954. 121p. Contract AF 33(616)-252, T. O. 4.

The preparation and polymerization of various monomeric materials for possible utilization in elastomers were investigated. Modifications of acrylon rubbers by

use of both copolymer and terpolymer systems were studied. (C.W.H.)

#### 4708 AEC-tr-2131

PRESSURE OF WATER VAPOR OVER MOLTEN SODIUM AND POTASSIUM HYDROXIDES. A. M. Bauman. Translated from *Zhur. Priklad. Khim.* 10, 1165-72(1937). 15p.

Water vapor pressures have been experimentally determined over molten NaOH and KOH with additions of carbonates and chlorides of Na and K. It was found that the addition of  $\text{K}_2\text{CO}_3$  and KCl to KOH and of  $\text{Na}_2\text{CO}_3$  to NaOH increases the water vapor pressure. The addition of up to 5% NaCl to NaOH has almost no effect. The heat of hydration of NaOH and KOH by water vapor was calculated. (M.P.G.)

#### 4709 AERE-Lib/Trans-523

IONIC CONDUCTIVITY OF THE MIXED SYSTEM  $\text{KCl-KBr}$  AND OF  $\text{KCl}$  WITH TRIVALENT ADDITIONS. H. Schulze. Translated by J. B. Sykes from Thesis, Univ. of Göttingen. 6p.

The ionic conductivity of the mixed system  $\text{KCl-KBr}$  shows a pronounced maximum, at about 70% molar KBr, for a constant temperature in the range of intrinsic conduction. The total conductivity curve of a mixed crystal as a function of temperature exhibits no specific differences from the ionic conduction of pure alkali halides. (auth)

#### 4710 T-157-R

THERMODYNAMIC CRITERIA FOR KINETIC EQUATIONS OF ELECTROCHEMICAL REACTIONS, S. V. Gorbachev. Translated by E. R. Hope from *Zhur. Fiz. Khim.* 27, 1362-9 (1953). 9p.

#### 4711

REACTIONS IN BORON TRIFLUORIDE-*n*-BUTYL ALCOHOL-Tri-*n*-BUTYL BORATE SYSTEMS. M. F. Lappert (Northern Polytechnic, London). *J. Chem. Soc.*, 784-90 (1955) Mar.

The syntheses, structures, and reactions of the difluoroboronates and fluoroboronates of the *n*-butyl series which result from chemical interactions in the boron trifluoride-*n*-butyl alcohol-tri-*n*-butyl borate system are described. (C.W.H.)

#### 4712

THE PREPARATION AND PROPERTIES OF TRIPHENYL BORATE AND THE PHENOXYBORON CHLORIDES. T. Colclough, W. Gerrard, and M. F. Lappert (Northern Polytechnic, London). *J. Chem. Soc.*, 907-11(1955) Mar.

Phenyl borate and dichlorophenoxyborine were obtained by interaction in approximate proportions of boron trichloride with phenol. Disproportionation reactions and addition compound formation of these compounds are discussed. (C.W.H.)

#### 4713

ACTIVITY COEFFICIENTS OF COMPONENTS IN THE SYSTEMS WATER-ACETIC ACID, WATER-PROPIONIC ACID AND WATER-*n*-BUTYRIC ACID AT 25°. Robert S. Hansen, Frederick A. Miller, and Sherril D. Christian (Iowa State Coll., Ames). *J. Phys. Chem.* 59, 391-5(1955) May.

Activity coefficients of components in the systems water-acetic acid, water-propionic acid, and water-*n*-butyric acid have been determined at 25° from experimental partial pressure measurements. Activity coefficient functions self consistent according to the Gibbs-Duhem equation are obtained from these data which represent the data in each system



over the entire concentration range. The representations appear to be very satisfactory over the entire concentration range for the systems water-acetic acid and water-*n*-butyric acid, but less satisfactory in the water-propionic acid systems at propionic acid mole fractions in excess of 0.3. Activity coefficients for water in fatty acid have been inferred from total vapor pressure measurements over the acid-rich portions of the concentration range for the systems water-*n*-valeric acid, water-*n*-caproic acid, and water-*n*-heptylic acid. These results have been combined with the other activity results and solubility measurements to establish the limiting increment per-CH<sub>2</sub>- group to the specific free energy of fatty acid at infinite dilution in water as 870 cal per mole. (auth)

#### 4714

THE ADSORPTION OF CESIUM IN LOW CONCENTRATION BY PAPER. Marvin L. Granstrom and Bernd Kahn (Oak Ridge National Lab., Tenn.). *J. Phys. Chem.* **59**, 408-10 (1955) May.

Carrier-free Cs<sup>137</sup> was adsorbed on Whatman #50 filter paper from aqueous solutions at a variety of pH values and cesium concentrations. The adsorption appears to take place by ion exchange and follows the Langmuir isotherm. No radiocolloidal properties were observed. (auth)

#### 4715

KINETICS OF THE OXIDATION OF SELENIOUS ACID BY HYDROGEN PEROXIDE. Francis J. Hughes and Don S. Martin, Jr. (Iowa State Coll., Ames). *J. Phys. Chem.* **59**, 410-15 (1955) May

The oxidation of selenious acid by aqueous hydrogen peroxide in strongly acid solutions is accompanied by decomposition of the peroxide. The rate of oxidation is given by the expression  $-d(\text{H}_2\text{SeO}_3)/dt = k_1(\text{H}_2\text{SeO}_3)^2(\text{H}_2\text{O}_2)/(\text{H}^+)$ . The rate is not affected by the presence of iron(III) or platinum which greatly accelerate peroxide decomposition. It is also independent of selenic acid concentration. Possible mechanisms for the oxidation are discussed. The decomposition rate of hydrogen peroxide is a complex function depending upon selenious acid, selenic acid, hydrogen peroxide and hydrogen ion concentrations. Small concentrations of selenious acid inhibit the decomposition, but high concentrations accelerate it. Therefore the decomposition reaction of hydrogen peroxide probably involves a selenium-containing species entering a free radical chain. Exchange of selenium between selenite and selenate in these systems does not occur. (auth)

#### 4716

THE VAPOR PRESSURES OF LITHIUM AND SODIUM OXIDES. Leo Brewer and John Margrave (Univ. of California, Berkeley). *J. Phys. Chem.* **59**, 421-5 (1955) May.

Theoretical calculations of the stability of alkali oxide gaseous molecules have been checked experimentally for Li<sub>2</sub>O and Na<sub>2</sub>O. The results indicate that Li<sub>2</sub>O vapor under neutral conditions may contain gaseous molecules in concentrations comparable to the gaseous elements. It is possible that both Li<sub>2</sub>O and LiO gaseous molecules may be important, especially under oxidizing conditions. Na<sub>2</sub>O vapor consists predominately of Na atoms and O<sub>2</sub> molecules with any oxide molecules being less important than the elements under neutral conditions. Thus Na gas and O<sub>2</sub> gas do not react with one another unless they are at high enough pressures to deposit solid or liquid Na<sub>2</sub>O. No experimental data are available for the heavier alkali oxides but the calculations indicate that gaseous MO molecules might be of im-

portance even under neutral conditions. The M<sub>2</sub>O gaseous molecules are expected to be less important than the MO or elemental molecules. In a hydrogen-oxygen system all of the alkali metals react to form stable gaseous hydroxides. (auth)

#### 4717

THERMAL DIFFUSION AND MOLECULAR MOTION IN LIQUIDS. E. L. Dougherty, Jr. and H. G. Drickamer (Univ. of Illinois, Urbana) *J. Phys. Chem.* **59**, 443-9 (1955) May.

A theory for thermal diffusion in liquids has been developed which permits the prediction of the separation using only molecular weights, molar volumes, activation energies for viscous flow, and excess thermodynamic properties. Measurements have been made on a series of binary mixtures of isomers with CS<sub>2</sub> at atmospheric pressure. These results and previously published results at high pressure are compared with the theory. There is excellent qualitative agreement, and in many cases the agreement is essentially quantitative. (auth)

#### 4718

THE EFFECT OF PRESSURE ON THE SOLUBILITY OF SOLIDS IN NON-POLAR LIQUIDS. E. P. Doane and H. G. Drickamer (Univ. of Illinois, Urbana). *J. Phys. Chem.* **59**, 454-7 (1955) May.

Solubility measurements under pressures to 10,000 atmospheres have been made in the following systems: phenanthrene in CS<sub>2</sub>, *n*-hexane, *n*-heptane, *n*-octane; SnI<sub>4</sub> in CS<sub>2</sub>, *n*-hexane, *n*-octane; C<sub>2</sub>Cl<sub>4</sub> in CS<sub>2</sub>, *n*-hexane, *n*-heptane, *n*-octane, 2-methylpentane, 3-methylpentane; 2,3-dimethylbutane, 2,2-dimethylbutane; anthracene in CS<sub>2</sub>. The results are analyzed in terms of Scatchard-Hildebrand theory. In general, the effects of molecular structure assume greater importance at the higher pressures, especially for *n*-heptane. (auth)

#### 4719

THE HEATS OF COMBUSTION AND FORMATION OF BORON CARBIDE. D. Smith, A. S. Dworkin, and E. R. Van Artsdalen (Oak Ridge National Lab., Tenn.). *J. Am. Chem. Soc.* **77**, 2654-6 (1955) May 5.

The heat of combustion of boron carbide is experimentally determined to be  $-683.3 \pm 2.2$  kcal/mole. Other thermodynamic data for boron carbide were derived from this value. (C.W.H.)

#### 4720

ON DECOMPOSITION OF FLUOBORATES OF ARYL DIAZONES AS A METHOD OF PREPARATION OF PURE BORON FLUORIDE. G. M. Panchenkov, V. M. Moiseev, and Yu. A. Lebedev (Moscow State Univ.). *Doklady Akad. Nauk S.S.S.R.* **100**, 1103-6 (1954) Feb. 21. (In Russian)

#### 4721

TIME LAG IN THE SELF-NUCLEATION. Hiromu Wakeshima (Kobe Univ. of Mercantile Marine, Japan). *J. Phys. Soc. Japan* **10**, 374-80 (1955) May.

An approximate but simple and general treatment of the time lag in self-nucleation is given. In this method the relation to be satisfied approximately by the rate of nucleation in nonsteady state is obtained and solved without first seeking the distribution of embryos. This calculation, when applied to the problem of condensation of water vapor in a high degree of supersaturation, gives a time lag of the same order of magnitude as that obtained by Probstein who solved the problem in ordinary way. Time lag of self-nucleation in the case of transformation in a solid is also computed. Cer-



tain limitation has been set therefrom to the validity of the notion of "athermal nucleation" as proposed by Turnbull et al., which presumes a large temporary lagging in the change of embryo distribution when, e.g., metals are quenched in phase transformations. (auth)

#### 4722

BUBBLE PICK-UP STUDIES WITH ALUMINA. P. K. Deshpande and G. N. Bhat (Indian Inst. of Sci., Bangalore, India). *J. Indian Inst. Sci.* A37, 141-6(1955) Apr.

Results obtained from pick-up studies on alumina with oleic acid and sodium silicate are presented and attempts are made to interpret them in the light of present flotation theories. (auth)

### ANALYTICAL PROCEDURES

#### 4723 NAA-SR-1153

North American Aviation, Inc., Downey, Calif.  
DETERMINATION OF BIPHENYL IN THE PRESENCE OF POLYPHENYLS—WATER SOLUBILITY METHOD. Louis Silverman and Mary Shideler. May 15, 1955. 26p. Contract AT-11-1-GEN-8.

Because of the relatively greater solubility of biphenyl in water, as compared to other polyphenyls, biphenyl is completely extracted from mixtures by water and determined spectrophotometrically in aqueous solution. Biphenyl has its maximum absorbance at 250  $m\mu$ . (auth)

#### 4724 NAA-SR-1226

North American Aviation, Inc., Downey, Calif.  
DETERMINATION OF SMALL QUANTITIES OF URANIUM IN THE PRESENCE OF LARGE AMOUNTS OF MERCURY. Betty G. Johnson. May 15, 1955. 15p. Contract AT-11-1-GEN-8.

A method for the determination of small amounts of uranium (milligram quantities) in the presence of large amounts (gram quantities) of mercury is reported. In this method, the mercury is removed from solution by reduction to metal with sulfur dioxide. The uranium is then determined by the ceric sulfate titration method. (auth)

#### 4725 NAA-SR-1264

North American Aviation, Inc., Downey, Calif.  
POTENTIOMETRIC DETERMINATION OF SMALL AMOUNTS OF URANIUM IN ZIRCONIUM. Louis Silverman and Mary Shideler. May 15, 1955. 21p. Contract AT-11-1-GEN-8.

Uranium may be determined, potentiometrically, in the presence of zirconium by passing the uranyl chloride solution through a lead reductor, catching the elutant in a ferric-ion (phosphate-free) solution, and titrating with sulfatoceric acid solution. The lower limit for the determination of pure uranium is 0.1 milligram, and in the presence of zirconium, the minimum uranium: zirconium weight ratio is 1:1,000. (auth)

#### 4726 UCRL-2948

California. Univ., Berkeley. Radiation Lab.  
NUCLEOPROTEIN FRACTIONS FROM VARIOUS EMBRYONIC TISSUES. A COMPARISON OF PHYSICO-CHEMICAL CHARACTERISTICS AND BIOLOGICAL ACTIVITY IN TISSUE CULTURE. Roman J. Kutsky, Rodes Trautman, Miriam Lieberman, and Relda M. Caillean. Apr. 7, 1955. 15p. Contract W-7405-eng-48.

Nucleoprotein fractions were isolated from extracts of twelve different tissues and organs of the 12-day chick embryo. The streptomycin method used was originally

developed to isolate from whole-chick-embryo extract a nucleoprotein fraction that stimulates growth of tissues in culture. Comparison of activities in tissue culture showed that the internal organ nucleoprotein fractions were much less active than those from tissues containing cartilage. Electrophoretic analysis disclosed a definite difference in pattern paralleling the biological activity. No such differences were found in the ultraviolet absorption spectra of the various nucleoprotein fractions. Electrophoretic subfractions were obtained from each nucleoprotein fraction and analyzed spectrophotometrically. Similar families of curves were found for the various sets of subfractions, with maxima ranging from 257  $m\mu$  to 275  $m\mu$ . Bioassays upon electrophoretic subfractions of the whole-embryo nucleoprotein fraction indicate that the biological activity is contained in a zone occupying approximately the middle third of the electrophoretic pattern. (auth)

#### 4727 AEC-tr-2147

QUANTITATIVE ANALYSIS OF INDIUM. D. Jentsch, I. Frotcher, G. Schwerdtfeger, and G. Sarfert. Translated from *Z. anal. Chem.* 144, 8-16(1955). 8p.

A method is described by which In can be quantitatively determined in the presence of Al, As, Pb, Fe, Ga, Ge, Cd, Co, Cu, Mn, Ni, Ag, Bi, Sn, and Zn. (L.T.W.)

#### 4728

SIMULTANEOUS DETERMINATION OF TOTAL CARBON AND CARBON-14 ACTIVITY. COMBUSTION METHOD. John D. Gabourel (Univ. of California, Davis) and Mary Jane Baker and Charles W. Koch (Univ. of California, Berkeley). *Anal. Chem.* 27, 795-7(1955) May.

Standard wet-combustion procedures for the determination of total carbon are not adequate for many compounds. The standard Pregl combustion procedure is not satisfactory for determining activity of carbon-14-labeled compounds, because of radioactive cross contamination between consecutive samples. Data have been obtained using a combustion method in which the tube packing consists of platinum gauze, granular quartz, manganese dioxide spread on platinized asbestos, and silver wool. The method gives the total carbon content with an accuracy comparable to that obtained from the Pregl tube packing without encountering cross contamination in the subsequent determination of carbon-14 activity. The hydrogen content may be obtained from the same determination. The procedure should permit the simultaneous determination of total carbon and  $C^{14}$  activity for any compound that can be analyzed by the conventional Pregl method. (auth)

#### 4729

ACTIVATION ANALYSIS OF TRACE IMPURITIES IN SILICON USING SCINTILLATION SPECTROMETRY. George H. Morrison and James F. Cosgrove (Sylvania Electric Products, Inc., Bayside, N. Y.). *Anal. Chem.* 27, 810-13(1955) May.

A method has been developed for the quantitative determination of trace impurities in silicon based on the use of neutron activation analysis. Gamma scintillation spectrometry and other physical methods for the measurement of radiations have been employed to identify and measure the amounts of the various impurities present. These physical methods minimize chemical manipulations, thereby eliminating loss or contamination during the course of the trace analysis. The accuracy and precision of the method were determined by analysis of an NBS standard aluminum alloy. A



sensitivity of 0.001 to 1  $\gamma$  is attained for most elements using this technique. (auth)

#### 4730

DETERMINATION OF MICROGRAM AND SUBMICROGRAM QUANTITIES OF URANIUM BY NEUTRON ACTIVATION ANALYSIS. H. A. Mahlman and G. W. Leddicotte (Oak Ridge National Lab., Tenn.). *Anal. Chem.* **27**, 823-5(1955) May.

Microgram and submicrogram quantities of uranium have been determined in synthetic samples, ores, and soils by neutron radioactivation analysis. The principles of the activation analysis method used in this determination and the processing of irradiated samples are discussed. This method of analysis is a sensitive and specific method for determining uranium in concentrations as small as 0.1  $\gamma$  per gram with a probable relative standard error of 10%. Concentrations of uranium in quantities as small as 0.0001  $\gamma$  per gram can be determined by neutron activation analysis. (auth)

#### 4731

DETERMINATION OF ZIRCONIUM IN MAGNESIUM ALLOYS USING p-BROMO- OR p-CHLOROMANDELIC ACID. Roland A. Papucci (F. C. Broeman and Co., Cincinnati) and Joseph J. Klingenberg (Xavier Univ., Cincinnati). *Anal. Chem.* **27**, 835-6(1955) May.

Successful application of p-bromo- and p-chloromandelic acids to the determination of zirconium in steel and aluminum alloys suggests a similar application to zirconium-containing magnesium alloys. Using these reagents, a rapid and reliable procedure was developed which can be applied to all types of magnesium alloys. (auth)

#### 4732

AN IMPROVED ACIDIMETRIC DETERMINATION OF FLUORIDE. J. M. Chilton and A. D. Horton (Oak Ridge National Lab., Tenn.). *Anal. Chem.* **27**, 842-4(1955) May.

In an unbuffered solution, the titration of a neutral solution of fluoride with aluminum ions results in an abrupt change of pH at the stoichiometric end point. Details of the separation of fluoride from interfering substances are presented; only phosphate and highly associated fluoride complexes require distillation. With the outlined procedure, in which a recording pH meter was used, fluoride was determined in a sodium fluoride solution with a standard deviation of less than 0.2%, and in a fluosilicate solution with a standard deviation of 0.6%. Analysis of four samples of NBS phosphate rock No. 120 yielded an average recovery of 99.1%. The method is applicable in the range of 0.1 to 3.5 mg of fluoride per ml of water. (auth)

#### 4733

ASSAY OF IRON-55 AND IRON-59 IN BIOLOGICAL SAMPLES. J. H. Rediske, R. F. Palmer, and J. F. Cline (General Electric Co., Richland, Wash.). *Anal. Chem.* **27**, 849-50(1955) May.

A method for determining quantities of  $\text{Fe}^{55}$  and  $\text{Fe}^{59}$  in a mixture was devised, based on the formation of the  $\text{Fe}^{55,59}$  thiocyanate complex and extraction by an isoamyl alcohol and diethyl ether mixture. An aliquot of this organic phase is pipetted onto a stainless steel plate, dried, and counted in a windowless, methane-flow, proportional counter. The ratios of the activities of each isotope are determined by counting through a 0.63 mg per sq cm rubber hydrochloride absorber. This absorber allows 0.66 mg per sq cm of the  $\text{Fe}^{59}$  activity to be detected, but only 0.015 of the  $\text{Fe}^{55}$  activity. (auth)

#### 4734

DERIVATIVES OF ANTHRARUFIN, CHRYSAZIN AND QUINIZARIN AS COLORIMETRIC REAGENTS FOR BORON. Everett C. Cogbill and John H. Yoe (Univ. of Virginia, Charlottesville). *Anal. Chim. Acta* **12**, 455-63(1955) May.

The spectrophotometric characteristics of the color reactions of six new reagents for boron are presented. These are derivatives of the dihydroxyanthraquinones, anthrarufin, chrysazin, and quinizarin, with amino, nitro, cyano, or halogen substituents. The spectral absorption characteristics of these reagents and their borate complexes are much more favorable for the colorimetric determination of boron than is the case with quinalizarin, which is commonly used for this purpose. With the exception of one of the six, all are more sensitive than quinalizarin. Two of them, tribromoanthrarufin and dicyanoquinizarin, are especially sensitive (spectrophotometric sensitivity: 0.0010  $\mu\text{g}/\text{cm}^2$ ). (auth)

#### 4735

m-NITROPHENYLARSONIC ACID AS A POLAROGRAPHIC REAGENT FOR TITANIUM. E. Vandalen and R. P. Graham (McMaster Univ., Hamilton, Canada). *Anal. Chim. Acta* **12**, 489-98(1955) May.

A sensitive polarographic method for titanium, based on its selective and quantitative precipitation with polarographically reducible m-nitrophenylarsonic acid is described. Factors affecting the quantitative precipitation—pH, concentration, of titanium and reagent nature and concentration of anions, and digestion—have been studied. (auth)

#### 4736

THE POLAROGRAPHIC REDUCTION OF FERRIC ION IN FLUORIDE MEDIA. Charles L. Rulfs and Graham A. Stoner (Univ. of Michigan, Ann Arbor). *J. Am. Chem. Soc.* **77**, 2653-4(1955) May 5.

At a pH of 5.8 a reversible ferric to ferrous reduction wave was observed with an  $E_{1/2}$  of  $-0.49\text{v}$  vs. S.C.E. in 1.0M fluoride. The variation of half-wave potential of ferric ion with fluoride concentration for  $[\text{F}^-] = 0.3$  to 1.0M indicates that one (or one additional) fluoride ion is being complexed. The diffusion coefficient of the complex is estimated as being  $5.8 \times 10^{-6} \text{ cm}^2 \text{ sec}^{-1}$ . (C.W.H.)

#### CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

##### 4737 AEC-tr-2136

ON THE EFFECT OF LATTICE DEFORMATION BY ELECTRONS ON THE OPTICAL AND ELECTRICAL PROPERTIES OF CRYSTALS. S. I. Pekar. Translated from *Uspekhi Fiz. Nauk* **50**, 197-252(1953). 92p. Available from Morris D. Friedman ([Trans. No.] D193575), West Concord, Mass.

The microtheory of the electron state in crystals is presented and the influence of micro-factors on interpretations of the phenomenological theory of the influence of electrons on optical and electrical properties of crystals is considered. (C.H.)

#### DEUTERIUM AND DEUTERIUM COMPOUNDS

##### 4738 NBS-3872

National Bureau of Standards, Washington, D. C. A REVIEW OF THE REACTION KINETICS OF DEUTERIUM COMPOUNDS. III. REARRANGEMENT—ISOMERIZATION



REACTIONS. Lawrence M. Brown and Abraham S. Friedman. Feb. 1, 1955. 41p.

The published literature on the kinetics of rearrangement-isomerization reactions of deuterium compounds has been reviewed for the period 1932 to 1953, inclusive. The review covers the ortho-para-deuterium conversion, the mutarotation of glucose, and the racemization of several organic deuterium compounds. Tabular summaries of the experimental data are included. (auth)

#### 4739

THE INFLUENCE OF TEMPERATURE ON THE ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES. J. Brun and Th. Varberg. *Kgl. Norske Videnskab. Selskabs, Forh.* 26, 19-21(1953). (In English)

Separation factors were obtained for the electrolytic separation of hydrogen isotopes in KOH solutions (steel cathode) over a temperature range of  $-19^{\circ}$  to  $+97^{\circ}\text{C}$ . The cathodic current density was  $0.05 \text{ amps/cm}^2$ . (C.W.H.)

#### 4740

A DIFFUSION-EQUILIBRATION METHOD AS A STAGE IN THE DETERMINATION OF THE DEUTERIUM OXIDE CONTENT IN 1-2 MICROLITRES OF FLUID. Lars Garby (Univ. of Upsala, Sweden). *Acta Chem. Scand.* 9, No. 2, 339-41 (1955).

A liquid sample of unknown deuterium oxide content is allowed to attain diffusion equilibrium with a sample of deuterium oxide-free distilled water, with a volume of air acting as a semipermeable membrane which allows only the deuterium oxide to pass through. At equilibrium, a density determination of the distilled water sample will give the original deuterium oxide concentration in the other sample. (C.W.H.)

### FLUORINE AND FLUORINE COMPOUNDS

#### 4741 AECU-2960

Michigan State Coll., East Lansing.  
PHYSICAL PROPERTIES OF THE HALOGEN FLUORIDES AND OF HALOGEN FLUORIDE-HYDROGEN FLUORIDE SYSTEMS. I. VAPOR PRESSURES OF HALOGEN FLUORIDE-HYDROGEN FLUORIDE SYSTEMS. II. SOLID-LIQUID EQUILIBRIA IN HALOGEN FLUORIDE-HYDROGEN FLUORIDE SYSTEMS. III. DENSITIES OF HALOGEN FLUORIDE-HYDROGEN FLUORIDE SOLUTIONS. IV. ELECTRICAL CONDUCTIVITIES OF THE HALOGEN FLUORIDES AND THEIR HYDROGEN FLUORIDE SOLUTIONS. V. MAGNETIC SUSCEPTIBILITIES OF THE HALOGEN FLUORIDES. Max T. Rogers, John L. Speirs, H. Bradford Thompson, and Morton B. Panish. Aug. 1954. 165p. Contract AT(11-1)-151.

This is the Doctorial thesis of Morton B. Panish. Pages I, II, III, missing.

Investigations on solid-liquid equilibria, electrical conductivities, and vapor pressures of the halogen fluorides and their hydrogen fluoride solutions, and on magnetic susceptibilities of the halogen fluorides are presented. The procedures, equipment, and techniques used are described in detail. (C.W.H.)

#### 4742 UCRL-2926

California. Univ., Berkeley. Radiation Lab.  
THE FLUORIDE COMPLEXING OF  $\text{Sc(III)}$ ,  $\text{Cu(II)}$ ,  $\text{Pb(II)}$ ,  $\text{Zn(II)}$ ,  $\text{Hg(II)}$ ,  $\text{Sn(II)}$ , AND  $\text{Ag(I)}$  IN AQUEOUS SOLUTION (thesis). Armine Deane Paul. Apr. 1955. 163p. Contract W-7405-Eng-48.

The fluoride complexing of  $\text{Sc}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Hg}^{2+}$ ,  $\text{Hg}_2^{2+}$ ,  $\text{Sn}^{2+}$ , and  $\text{Ag}^+$  in aqueous solutions at 15, 25, and  $35^{\circ}\text{C}$  has been studied by EMF methods. Various thermodynamic data have been obtained. (C.W.H.)

#### 4743

DECOMPOSITION OF MIXED DIAZONIUM FLUOROBORATES. J. C. Brunton and H. Suschitzky (West Ham College of Technology, England). *J. Chem. Soc.*, 1035(1955) Mar.

Experiments indicate that diazonium fluoroborates in admixture decompose without appreciable interaction. This method offers a convenient way for the simultaneous preparation of two separable aromatic fluorine compounds. (C.W.H.)

#### 4744

THE THEORETICAL ENERGIES OF MIXING FOR FLUOROCARBON-HYDROCARBON MIXTURES. T. M. Reed, III (Univ. of Florida, Gainesville). *J. Phys. Chem.* 59, 425-8(1955) May.

Hydrocarbons and fluorocarbons have two properties which differ to such an extent that the usual equations, found in the Hildebrand regular solution theory, for calculating energies of mixing are rendered inaccurate for mixtures containing both of these kinds of molecules. These properties are the molal volume and the molecule ionization potential. The latter enters into the potential energy function for nonpolar molecules as given by the London formula for the dispersion effect. A more accurate equation for calculating energies of mixing which includes the effects of these properties is obtained from theory. It is found that the ratio 1.55 of the ionization potential of  $n\text{-C}_8\text{F}_{12}$  to that of  $n\text{-C}_8\text{H}_{12}$  is sufficient to account for about 25% of the calculated partial molal energies of mixing in liquid solutions of these two compounds. These calculated energies, as well as those for the system  $n\text{-C}_4\text{F}_{10} : n\text{-C}_4\text{H}_{10}$ , agree very well with experimental partial molal heats of mixing reported in the literature. (auth)

### GRAPHITE

#### 4745

THEORY OF THE SPECIFIC HEAT OF GRAPHITE. II. Kozo Komatsu (Naniwa Univ., Sakai, Japan). *J. Phys. Soc. Japan* 10, 346-56(1955) May.

The previous theory by the author and Nagamiya (1951) is improved in this paper by introducing the shearing elastic constant  $c_{44}$ , which is estimated by a procedure similar to that employed by Brennan. This shearing elastic constant couples the two types of vibrations, those normal to the hexagonal layers and those parallel. The theory shows that below  $10^{\circ}\text{K}$  the deviation from  $T^2$  law becomes appreciable and the range of transition from  $T^2$  to  $T^3$  laws appears at a few degrees absolute. The calculated values agree with the experimental ones over the whole temperature range below  $60^{\circ}\text{K}$ . Comments are given on recent other theories. (auth)

### LABORATORIES AND EQUIPMENT

#### 4746 NRL-4534

Naval Research Lab., Washington, D. C.  
A CONVENIENT METHOD OF DETERMINING VAPOR PRESSURE. INTERIM REPORT. John M. Leonard and John D. Bultman. Apr. 7, 1955. 7p.

A simple, rapid method of vapor pressure determination has been developed at NRL. The procedure, similar in



principle to that of Smith and Menzies, is equally adaptable to solids and liquids. Experiments on nine materials of known vapor pressure characteristics exemplify the utility of the method. (auth)

#### 4747 ORO-140

North Carolina State Coll., Raleigh.

THE PERFORMANCE CONTACTORS FOR LIQUID-LIQUID EXTRACTION. PROGRESS REPORT NO. 3 (PRELIMINARY). THE APPLICATION OF STATISTICAL PROCEDURES TO A STUDY OF THE FLOODING CAPACITY OF A PULSE COLUMN. [PART] I. THE BEHAVIOR OF THE SYSTEM TRICHLOROETHYLENE-WATER. F[rederick] Philips Pike, Joseph R. Nelli, Eugene E. Erickson, and Donald S. Arnold. [PART] II. STATISTICAL DESIGN AND ANALYSIS. George E. P. Box and J. Stuart Hunter. Feb. 1954. 89p. Contract AT(40-1)-1320.

Statistical techniques of experimental design and analysis have been utilized for a study of the flooding capacity of a pulse column. The flooding behavior of the trichloroethylene-water system at room temperature was experimentally determined. Analysis of these experimental results indicated that trace contamination in a major factor in pulse column flooding. (C.W.H.)

#### 4748 ORO-141

North Carolina State Coll., Raleigh.

THE PERFORMANCE OF CONTACTORS FOR LIQUID-LIQUID EXTRACTION. PROGRESS REPORT NO. 4. THE FLOODING CAPACITY OF A PULSE COLUMN ON THE BENZENE-WATER SYSTEM. F[rederick] Philips Pike, Eugene E. Erickson, Joseph R. Nelli, and J. Stuart Hunter. Apr. 18, 1954. 41p. Contract AT(40-1)-1320.

The flooding behavior of the benzene-water system was experimentally determined. Reduction of grease contamination greatly improved the reproducibility of the extraction system. A new technique was developed for describing the pulse column flooding behavior. (C.W.H.)

#### 4749 AEC-tr-2148

NEW CONDUCTIVITY CELL. E. Gand. Translated from Bull. soc. chin. France, 849-51(1950). 3p.

An electric conductivity cell is described with interchangeable electrodes for making measurements in a closed vessel. (L.T.W.)

### RADIATION CHEMISTRY

#### 4750

CHEMICAL EFFECTS OF X-RAYS UPON AQUEOUS SOLUTIONS OF CORTISONE AND DEOXYCORTICOSTERONE.

R. Allinson, B. Coleby, and J. Weiss (Univ. of Durham, Newcastle upon Tyne, England). *Nature* **175**, 720-1(1955) Apr. 23.

The isolation and identification of products formed from cortisone and deoxycorticosterone when their deaerated aqueous solutions are irradiated with 200-kv x rays are reported. Dehydroxylation and hydrogenation of double bonds in the two organic compounds were observed as effects of x irradiation. (C.W.H.)

#### 4751

X-RAY DOSIMETRY BY RADIOLYSIS OF SOME ORGANIC SOLUTIONS. I. DITHIZONE AND METHYL YELLOW SOLUTIONS. George L. Clark and Paul E. Bierstedt, Jr. (Univ. of Illinois, Urbana). *Radiation Research* **2**, 199-218 (1955) May.

Dithizone and methyl yellow in nonaqueous solutions were

studied in a search for radiation-sensitive systems for dosimetric purposes. Quantitative energy relationships were established using a number of solutes and data are tabulated in terms of the number of molecules reacting per 100 ev and the number of molecules reacting per roentgen absorbed. The logical possibilities of a free radical mechanism for the indirect effects upon the solute molecules are derived from the data. (C.H.)

### RARE EARTHS AND RARE-EARTH COMPOUNDS

#### 4752

REMOVAL OF PEROXIDES FROM ETHERS WITH CEROUX HYDROXIDE. J. B. Ramsey and F. T. Aldridge (Univ. of California, Los Angeles). *J. Am. Chem. Soc.* **77**, 2561-2 (1955) May 5.

Cerous hydroxide,  $Ce(OH)_3$ , reacts quantitatively and readily with peroxides in ethers to form a substance which is insoluble and which can therefore be separated from the ethers by filtration or decantation. (C.W.H.)

#### 4753

OBSERVATIONS ON THE RARE EARTHS. LXV. NAPHTHAZARIN COMPLEXES OF CERTAIN RARE EARTH METAL IONS. Therald Moeller and Melvin Tecotzky (Univ. of Illinois, Urbana). *J. Am. Chem. Soc.* **77**, 2649-50(1955) May 5.

Spectrophotometric studies on the reactions between rare earth ions and naphthazarin and evaluations of the compositions of the colored complexes obtained are reported. (C.W.H.)

### SEPARATION PROCEDURES

#### 4754 AERE-C/M-221

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE QUANTITATIVE SEPARATION OF ALUMINIUM AND ZIRCONIUM BY ANION EXCHANGE. F. W. Cornish and A. Thomas. Dec. 1954. 6p.

Aluminum and zirconium were separated quantitatively using a column of the resin Deacidite FF. (L.T.W.)

### SORPTION PHENOMENA

#### 4755 AEC-tr-2144

ACTIVATED DIFFUSION IN POROUS ADSORBENTS. R. A. W. Haul. Translated by S. S. Kirselis from *Z. physik. Chem.* (Frankfurt) (N. F.), **1**, 153-75(1954). 21p.

Adsorption velocities on pressed adsorbents at constant gas pressure were measured by means of a sorption balance. The adsorption velocities are dependent upon two transport processes in the porous adsorbent, namely, molecular gaseous diffusion and surface diffusion. The solution of the differential equation of diffusion for the given boundary conditions gives immediately effective diffusion coefficients. From these, taking into account Knudsen flow diffusion coefficients determined by permeability measurements, surface diffusion coefficients can be obtained. As an example, the diffusion of n-butane into powder packs of "Linde Silica" was studied in its dependence on temperature, porosity, and the surface concentration. The surface diffusion coefficients ( $D_s$ ) are of the order of magnitude 1 to  $10 \times 10^{-6}$  cm.<sup>2</sup>/sec. From the temperature dependence, the activation energy was found to be 2900 cal./mole, for a heat of adsorption of 6000 cal./mole and a  $d_p$  value for the surface diffusion without hindrance of  $1.2 \cdot 10^{-2}$  cm.<sup>2</sup>/sec. The



surface diffusion coefficient decreased with decreasing porosity of the adsorbent. The dependence on the surface concentration was studied by several methods. In the region of a monolayer with  $y_m$  millimoles of butane per gram of adsorbent,  $D_s$  is practically constant and diminishes below about 0.7  $u_m$ . The concept "surface diffusion" is discussed, and with consideration of the complex relationships in porous adsorbents the general expression "activated diffusion" is preferred. (auth)

## SPECTROSCOPY

### 4756

ISOTOPIC EFFECT IN ATOMIC SPECTRA. A. R. Striganov and Yu. P. Dontsov. Uspekhi Fiz. Nauk 55, 315-90(1955) Mar. (In Russian)  
A review. 214 references.

### 4757

INTERFEROMETRIC WAVELENGTHS OF IRON LINES FROM A HOLLOW CATHODE DISCHARGE. R. W. Stanley and G. H. Dieke (Johns Hopkins Univ., Baltimore). J. Opt. Soc. Amer. 45, 280-6(1955) Apr.

Interferometric wavelength measurements (3570 Å to 5709 Å) are given for 189 iron lines produced by a hollow cathode discharge. The lines are considerably sharper than those of the iron arc and the available evidence shows that the wavelengths are invariant with any changes in operating conditions of the tube. The hollow cathode discharge tube in neon with iron electrodes appears to be the best source of standards for wavelength measurements. (auth)

## TRACER APPLICATIONS

### 4758

RADIOCARBON DATES OF PRE-MANKATO EVENTS IN EASTERN AND CENTRAL NORTH AMERICA. Richard Foster Flint (Yale Univ., New Haven, Conn.) and Meyer Rubin (U. S. Geological Survey, Washington, D. C.). Science 121, 649-58(1955) May 6.

Radiocarbon dates assigned a group of samples of wood confirm the time of events of the last major glaciation preceding the Mankato in North America and its European equivalent, the Fennoscandian. A brief critical assessment is presented of the stratigraphic meaning of the pre-Mankato samples. (C. H.)

## TRITIUM AND TRITIUM COMPOUNDS

### 4759

PRODUCTION OF RADIOACTIVE ORGANIC COMPOUNDS WITH RECOIL TRITONS. Richard Wolfgang (Brookhaven National Lab., Upton, N. Y.) and F. S. Rowland and C. Nigel Turton (Princeton Univ., N. J.). Science 121, 715-17 (1955) May 20.

A process which utilizes the momentum properties of nuclei formed in nuclear events has been devised to incorporate radioactive recoil hydrogen atoms into previously inactive organic molecules. Chemical separation of a  $Li_2CO_3$  - glucose mixture which had been neutron-irradiated yielded glucose which had tritium incorporated in nonlabile positions. A limitation of the process is that it will not be possible to produce compounds labeled at specific positions. (C.W.H.)

## URANIUM AND URANIUM COMPOUNDS

### 4760

EFFECT OF URANYL CHLORIDE UPON ADENOSINETRI-PHOSPHATASE OF MYOSIN. William J. Bowen and Timothy D. Kerwin (U. S. Dept. of Health, Education and Welfare, Bethesda, Md.). Proc. Soc. Exptl. Biol. Med. 88, 515-17(1955) Apr.

## ENGINEERING

### 4761

AERE-Inf/Bib-93(2nd Ed.)  
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ELECTROMAGNETIC PUMPS AND FLOWMETERS. A BIBLIOGRAPHY OF LITERATURE REFERENCES AND READILY AVAILABLE REPORTS. M. Greenhill. 1955. 4p.

### 4762 UCLA-332

California. Univ., Los Angeles. Atomic Energy Project. BEHAVIOUR OF SHOCK WAVES ENTERING MODEL BOMB SHELTERS. B. B. Dunne and Benedict Cassen. Apr. 25, 1955. 19p. Contract AT-04-GEN-12.

The use of a spark shadowgraph with effective exposure time of a fraction of a microsecond has enabled very sharp pictures to be obtained of the time sequence of shock wave advance, reflection, diffraction, and turbulent breakup in models placed in a 4 × 4 inch square cross section shock tube. The equipment has been used to gain considerable information on the penetration of shock waves into model shelters. Although it is expected that inertial forces would scale accurately in small models, it is evident from the results that viscous forces play an important part in kinetic energy dissipation, and these forces would not be expected to scale accurately. However, the production and behavior of strong vortices in the models indicate that they should be considered as a full-scale factor in effects on personnel. (auth)

### 4763 UCRL-4497

California. Univ., Livermore. Radiation Lab. SMALL ELECTRIC MOTORS FOR USE IN HIGH-VACUUM SYSTEMS USING OIL-DIFFUSION PUMPS. Alfred R. Taylor. May 6, 1955. 2p. Contract W-7405-eng-48.

## HEAT TRANSFER AND FLUID FLOW

### 4764 ARC-16679

Gt. Brit. Aeronautical Research Council. Fluid Motion Sub-Committee.

THE HOT-WIRE ANEMOMETER FOR TURBULENCE MEASUREMENTS. PART III. B. Wise and D. L. Schultz. Mar. 24, 1954. 71p. (FM-1527b)

Further investigation of the operation of the hot-wire anemometer has shown that there are only two systems which are both statically stable and capable of improving the frequency response. A description is given of further experiments which have been made to verify the theory of operation of the wire, using both radio-frequency and direct current heating. An analysis of some feedback systems is given, and it is shown how these techniques may be used in the measurement of turbulence at high air speeds. (auth)



**4765** BRL-Memo-830

Ballistic Research Labs., Aberdeen Proving Ground, Md.  
HIGH-SPEED COMPUTING MACHINE CALCULATION OF  
SUPERSONIC AXISYMMETRIC FLOWS. Martha W. Clark.  
Sept. 1954. 35p.

The mathematical basis for machine calculation of  
supersonic axisymmetric flows of air is presented. The  
numerical method giving information on operating proce-  
dures and flow charts with special emphasis on an avail-  
able ORDVAC routine is described. (auth)

**4766** NACA-RM-L9B28

Langley Aeronautical Lab., Langley Field, Va.  
INVESTIGATIONS OF AN ANNULAR DIFFUSER-FAN  
COMBINATION HANDLING ROTATING FLOW. Ira R.  
Schwartz. Apr. 25, 1949. 34p.

Two annular diffusers of constant outer diameter have  
been investigated with rotating flow. The performance  
characteristics have been determined over a range of  
inlet Mach numbers from 0.1 to 0.55 and at angles of flow  
up to 28°. A wide range of flow distributions was encoun-  
tered as a result of changes in operating conditions of the  
fan used to generate the rotation. The over-all perform-  
ance of an 8° diffuser is shown to be substantially better  
than that of a 16° diffuser under comparable conditions  
included in the limits of the investigation. (NACA abst.)

**4767** NACA-TN-1713

Lewis Flight Propulsion Lab., Cleveland.  
EXPERIMENTAL STUDY OF EFFECT OF VANELESS-  
DIFFUSER DIAMETER ON DIFFUSER PERFORMANCE.  
Guy R. Bradshaw and Eugene B. Laskin. [June 24, 1948].  
28p.

The variations in compressor and diffuser efficiency  
with diffuser diameter were studied on four vaneless dif-  
fusers of different diameter. Over-all efficiency increased  
with diffuser diameter. In all the diffusers, losses in ef-  
ficiency were limited to the entrance and exit regions,  
losses in the interior of the diffuser being negligible.  
(NACA abst.)

**4768** NACA-TN-3296

Brooklyn. Polytechnic Inst.  
SEPARATION, STABILITY, AND OTHER PROPERTIES OF  
COMPRESSIBLE LAMINAR BOUNDARY LAYER WITH  
PRESSURE GRADIENT AND HEAT TRANSFER. Morris  
Morduchow and Richard G. Grape. [Apr. 7, 1954]. 45p.

A theoretical study is made of the effect of pressure  
gradient, wall temperature, and Mach number on  
laminar boundary-layer characteristics and, in particular,  
on the skin-friction and heat-transfer coefficients, on the  
separation point in an adverse pressure gradient, on the  
wall temperature required for complete stabilization of  
the laminar boundary layer, and on the minimum critical  
Reynolds number for laminar stability. A simple and  
accurate method of locating the separation point in a  
compressible flow with heat transfer is developed. (auth)

**4769** NACA-TN-3397

Lewis Flight Propulsion Lab., Cleveland.  
AN EVALUATION OF NON-NEWTONIAN FLOW IN PIPE  
LINES. Ruth N. Weltmann. [Nov. 26, 1954]. 40p.

An analysis is presented of a method for determining  
pressure losses due to the flow of non-Newtonian materials  
in pipe lines by using basic flow data obtained from  
measurements of flow curves, which are rate-of-shear-  
shearing-stress curves. The advantages of properly  
designed rotational viscometers over capillary viscometers

for measuring these flow curves and interpreting them to  
obtain the basic flow parameters are discussed. Dimen-  
sionless parameters are calculated from these basic flow  
data and are used to construct a generalized friction  
diagram to describe the flow characteristics of Newtonian  
and non-Newtonian materials in pipe lines. (auth)

**4770** NP-5644

Wayne Univ., Detroit.

NATURAL CONVECTION HEAT TRANSFER—TWO AND  
THREE DIMENSIONAL EFFECTS FROM FLAT PLATES.  
Joseph Rutkowski. May 17, 1955. 21p. Contract DA-20-  
018-ORD-13356.

Natural convection heat transfer from heated flat plates  
was studied using a Mach-Zehnder interferometer. The  
initial problem in experimental heat transfer using the  
interferometer was to establish criteria for correcting  
interferometric data for finite flat plate effects in order to  
establish one-dimensional heat and fluid flow conditions.  
The edge effect was found to be almost independent of plate  
temperature, geometry, or inclination, and suitable correc-  
tions can be readily made from the reported data. The ex-  
perimental survey of temperature profiles for the heated  
flat plates led to a theoretical prediction of the profile as  
being accurately described by the value of (1 = probability  
integral). (auth)

**4771** ORO-142

North Carolina State Coll, Raleigh.

THE PERFORMANCE OF CONTRACTORS FOR LIQUID-  
LIQUID EXTRACTION. PROGRESS REPORT NO. 7.  
PRESSURE-DROP BEHAVIOR FOR SINGLE-PHASE FLOW  
THROUGH A PERFORATED-PLATE ASSEMBLY. William  
Thomas Lewish and Frederick Philips Pike. May 6, 1954.  
184p. Contract AT(40-1)-1320.

Submitted as a thesis by William Thomas Lewish. 1954.

The pressure drop characteristics of single-phase liquid  
flow through a bank of perforated plates installed in a  
column were studied. Factors controlling the pressure drop  
include the plate geometry, the plate spacing, the clearance  
effect, and the end effect. The importance of vortex actions  
as a factor in fluid flow is emphasized. (C.W.H.)

**4772** AEC-tr-2133

ON THE THERMODYNAMICS OF THE OPERATING GASES  
OF ATOMIC ROCKETS. (Zur Thermodynamik Von  
Arbeitsgasen Für Atomraketen). Irene Sängner-Bredt.  
Translated from Z. Naturforsch. 8a, 796-804(1953). 12p.

An analysis is presented of the problem of accelerating  
an operating gas for thermal atomic rockets to the greatest  
possible exhaust velocity in a nozzle. It is shown that, using  
diathermal propulsion gases with little radiation, such as H,  
and low boiler pressures, exhaust velocities up to ~30,000  
m/sec can be achieved. In comparison, He, as the prototype  
of light inert gases, shows higher exhaust velocities in the  
range of moderate heating enthalpies but much higher com-  
bustion gas temperatures. (M.P.G.)

**4773** CTS-62

ON THE THEORY OF THE HEAT TRANSFER FROM A  
BOILING FLUID. L. S. Serman. Translated from Zhur.  
Tekh. Fiz. 23, 341-51(1953). 10p. Available from  
Charles House, London, England.

The differential equations describing the heat transfer by  
convection during the boiling process, and the equations  
defining the conditions for the transfer of heat during boil-  
ing from the laminar transition layer to the turbulent core,



are deduced. A functional relationship between the similarity criteria for the case of heat interchange during the boiling process is established. The experimental data for the determination of the critical heat flow values during boiling in a large volume, and some data regarding the interchange of heat during the boiling process in pipes, are represented in the form of defined characteristic relations. (auth)

**4774** NACA-TM-1137

THE TURBULENT FLOW IN DIFFUSERS OF SMALL DIVERGENCE ANGLE. G. A. Gourzhienko. Translated by S. Reiss from Central Aero-Hydrodynamical Inst. Report No. 462, 1939, Moscow. 77p.

Formulas are derived for computing velocity and pressure distributions in the turbulent flow along, and perpendicular to, the axis of a diffuser of small cone angle. Measured velocity and pressure distributions in two conical diffusers with angles of 1 and 2° are presented and compared with theoretical values. A first, very approximate, attempt is made at estimating semiempirically the deviation of the true motion from the radial pattern assumed. (NACA abst.)

**4775**

ON THE VELOCITY DISTRIBUTION OF TURBULENT FLOW BEHIND A SYSTEM OF THIN CYLINDRICAL RODS. R. Gran Olsson. *Kgl. Norske Videnskab. Selskabs, Forh.* 26, 70-5(1953). (In English)

The velocity distribution behind a system of cylindrical equidistant rods is found by using the expression of L. Prandtl for the shear stress in turbulent motion (mixing length theory). The solution of the differential equation is given in terms of the elliptical functions of Weierstrass, which for the numerical calculation are transformed to the elliptic functions of Jacobi. The results are in close agreement with those obtained earlier by simple quadrature. (auth)

**RADIOGRAPHY**

**4776**

GAMMA-RADIOGRAPHY IN OIL STORAGE INSTALLATIONS. IV. C. C. Bates (Welding Supervision Ltd., London). *Atomics* 6, 144-7, 50(1955) May.

Health and safety precautions to be applied in work involving  $\gamma$  radiography in oil storage installations are reviewed. (L.T.W.)

## MINERALOGY, METALLURGY, AND CERAMICS

**4777** NYO-4630

Massachusetts Inst. of Tech., Cambridge.

STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING APRIL 1, 1955. F. H. Norton and W. D. Kingery. Apr. 1, 1955. 16p. Contract AT(300-1)-1192.

Measurements of surface tension and contact angles of Ni-Cr and Ni-Ti alloys indicate that Cr and Ti are adsorbed at the interface much the same way as is Si from Fe-Si alloys. The adsorption of Ti is appreciable at concentrations of 0.1 weight percent. Alloys containing sur-

face-active materials are shown to wet oxides. Atmospheric purity is very important. Additional quantitative analysis of sintering data are in agreement with previous qualitative conclusions. (For preceding period see NYO-6297.) (auth)

**4778** PA-TR-2092

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

DETERMINATION OF AVERAGE SURFACE DIAMETER AND TAPPED DENSITY OF POWDERED PYROTECHNIC INGREDIENTS. Bernard Dubrow and Mary Nieradka. Nov. 1954. 31p. (AD-47231)

Three test methods applicable to the specification of the average particle size and tapped density of powders are described. These methods are: a calibration method for a sub-sieve sizer; an instrumental method for surface diameter measurement; an instrumental method for tapped density determination. (C.W.H.)

**CERAMICS AND REFRACTORIES**

**4779** NYO-6449

Massachusetts Inst. of Tech., Cambridge.

THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS. QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING APRIL 1, 1955. F. H. Norton and W. D. Kingery. Apr. 1, 1955. 16p. Contract AT(30-1)-960.

Thermal conductivity data are reported for SiC, frit-bonded SiC, Si bonded SiC, HfO<sub>2</sub>, and 95 MgO-5 SiO<sub>2</sub>. Design of apparatus for determining absorption of radiant energy at elevated temperatures, preparation of polycrystalline aggregates, and a study of heat conduction in powder masses are in progress. (auth)

**4780** WAL-13

Alfred Univ., Alfred, N. Y.

EXPLORATORY RESEARCH IN THE FIELD OF CONTAINER MATERIALS FOR TITANIUM. FINAL REPORT. W. B. Crandall, K. D. Scheffer, C. H. McMurtry, and R. B. Burdick. Jan. 31, 1955. 46p. Contract DA-30-115-ORD-498.

Five intermetallic combinations were investigated as containers for Ti. These were: Si-Zr, Al-Zr, Al-Ca, Al-Mo, and Mo-Zr. The selected compounds were synthesized, hot-pressed into crucibles, cleaned, and tested in the following manner: (1) Ti-75A and the alloy RC-130AW were melted in crucibles of the selected compositions for various times and degrees of superheat, up to 10 min at 150°C above the melting points, (2) evaluation of the solidified melts were made by hardness tests, microstructure examination, carbon analysis, and quantitative spectrographic determinations of the percentages of Si, Mo, Al and Zr. From the tests conducted, it was determined that the crucibles formed from Mo<sub>3</sub>Al rendered melts of the best quality of all those tested, with Mo<sub>3</sub>Zr crucibles showing the next relative importance. Although the melts were contaminated by the furnace atmosphere, it was determined that they were picking up only a small and constant amount of crucible constituents, thus placing relatively high significance on Mo<sub>3</sub>Al as a container material for Ti. (auth)

**4781** AERE-Lib/Trans-466

APPLICATION OF SORPTION METHOD TO THE STUDY OF THE INTERACTION OF ZIRCONIUM OXIDE WITH THE OXIDES OF CALCIUM AND MAGNESIUM. E. N. Nikitin.



Translated by V. Beak from Doklady Akad. Nauk S.S.S.R. 94, 919-21(1954). 4p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-3994.

## CORROSION

### 4782 EES-040028K

Naval Engineering Experiment Station, Annapolis. INVESTIGATION OF STRESS-CORROSION OF AUSTENITIC STAINLESS STEELS AND OTHER MATERIALS IN HIGH TEMPERATURE WATER ENVIRONMENTS. SUMMARY OF WORK FROM JANUARY 1951 TO JANUARY 1955. W. Lee Williams. Mar. 29, 1955. 88p.

Data are summarized from an investigation of the stress corrosion behavior of various constructional materials in high-temperature water. Data are presented on the behavior of austenitic stainless steels, martensitic and ferritic stainless steels, nickel base alloys, and a few miscellaneous materials. The principal variables studied included alloy composition, stress level, water composition, liquid versus vapor exposure, and stress-corrosion inhibitors. Data are presented on both laboratory tests and experiments with actual equipment. (C.H.)

### 4783 TT-335

THEORY OF CORROSION PROCESSES. IV. ON THE APPLICATION OF THE THEORY OF LOCAL CELLS TO THE PROBLEMS OF CORROSION. (Zur Theorie Der Korrosionserscheinungen. IV. Über Die Anwendung Der Theorie Der Lokalelemente Auf Die Probleme Der Korrosion). W. J. Müller. Translated by D. A. Sinclair from Korrosion U. Metallschutz 12, 132-8(1936). 21p.

### 4784 TT-346

ON THE THEORY OF CORROSION PROCESSES. V. ON THE RELATIONSHIP BETWEEN POTENTIAL VALUE, CORROSION AND CORROSION PASSIVITY OF METALS IN AQUEOUS SOLUTIONS. (Zur Theorie Der Korrosionserscheinungen. V. Über Den Zusammenhang Zwischen Potentialeinstellung, Korrosion Und Korrosionspassivität Von Metallen In Wässrigen Lösungen). W. J. Müller. Translated by D. Sinclair from Korrosion U. Metallschutz 13, 144-57(1937). 37p.

## GEOLOGY AND MINERALOGY

### 4785

METHODS OF ISOTOPIC PALEOTHERMOMETRY. R. V. Teis (Moscow). Uspekhi Khim. 24, 163-80(1955). (In Russian)

### 4786

URANIUM PRODUCTION IN SOUTH AFRICA. Peter Holz. Atomica 6, 130-3(1955) May.

## METALS AND METALLURGY

### 4787 AD-7882

Rem-Cru Titanium, Inc., Midland, Penna. THE DEVELOPMENT OF STRONG, TOUGH TITANIUM ALLOYS FOR ORDNANCE USE. LETTER REPORT NO. 5 FOR THE PERIOD MARCH 1, 1953 TO MARCH 31, 1953. R. W. Parcel. Apr. 10, 1953. 19p. Contract DA-19-059-ORD-1007.

The physical properties of several Ti-Mn alloys which had been subjected to varying heat treatments were

determined for a study of the effects of interstitial elements on alloy properties. (C.W.H.)

### 4788 AD-30757

Battelle Memorial Inst., Columbus, Ohio. A METALLURGICAL STUDY OF MOLYBDENUM. QUARTERLY STATUS REPORT NO. 17 COVERING THE PERIOD JULY 15, 1953 TO OCTOBER 31, 1953. Oct. 31, 1953. 71p. Contract N9onr 82100, T. O. 1.

Further work has been done to determine the validity of the bend test as a means of measuring the ductility of Mo. Fractographic examinations were made of ingots prepared by vacuum fusion. The studies on the effects of impurities and neutralizers on the ductility of cast Mo were continued. Work on the "solid-state purification" process indicates that the heat treatment has an important effect on the final ductility of the sample. (C.W.H.)

### 4789 AD-38005

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STUDY OF EFFECTS OF ALLOYING ELEMENTS ON THE WELDABILITY OF TITANIUM SHEET. QUARTERLY REPORT NO. 6 [FOR] APRIL 16, 1954 TO JUNE 15, 1954. H. M. Meyer and Orville T. Barnett. July 7, 1954. 50p. Contract AF33(616)-206.

Titanium-vanadium alloys of various compositions were prepared and tested in an effort to find a metastable  $\beta$  alloy. The mechanical properties and structural characteristics of these alloys are reported. (For preceding period see AD-35109.) (C.W.H.)

### 4790 AD-38048

Kentucky. Univ., Lexington. Kentucky Research Foundation.

SCALING OF TITANIUM AND TITANIUM ALLOYS. PROGRESS REPORT NO. 9. [FOR APRIL 1, 1954 TO JULY 1, 1954]. H. J. Siegel and R. C. Duncan. July 1, 1954. 27p. Contract AF18(600)-60.

The arc melting and fabrication of Ti alloys for use as scaling test specimens and the compilation of scaling data of the weight-increase type are reported. (C.W.H.)

### 4791 AD-38918

American Electro Metal Corp., Yonkers, N. Y. INVESTIGATION AND EVALUATION OF NEW HIGH TEMPERATURE MATERIALS. PROGRESS REPORT NO. 6 [FOR] MARCH 1, 1954-MAY 31, 1954. [William Arbiter]. 32p. Contract AF33(616)-109.

A large number of Cr-Ti-O compositions have been prepared and tested at elevated temperature to determine oxidation resistance and strength. A series of melting experiments was undertaken to determine the possibility of binding selected silicides with a pure metal. (auth)

### 4792 BMI-994

Battelle Memorial Inst., Columbus, Ohio. ENAMELING OF ZIRCONIUM. J. Schultz. H. P. Tripp, B. W. King, and W. H. Duckworth. Apr. 27, 1955. 24p. Contract W-7405-eng-92.

The problems involved in enameling Zr with vitreous enamels were investigated, and enamel compositions were developed. The major problems in enameling Zr with adherent, defect-free coatings resulted from: (1) the relatively low coefficient of thermal expansion of Zr; (2) the directional thermal-expansion properties rolled Zr; (3) the undesirability of using enamel components of high thermal neutron absorption cross section; and (4) the desir-



ability of fusing the enamel below 1475°F to avoid the alpha-beta transformation of Zr when firing the coating. These problems were solved by suitable heat treatment of the Zr to reduce directional properties and the use of a lead silicate type of enamel. Coatings were also developed for application at temperatures above the Zr alpha-beta transformation point. In some cases, these enamels could only be used as cover coats because they did not wet Zr very well. Conventional methods of enamel processing and application were used. (auth)

**4793 CAL-KD-752-M-4**

Cornell Aeronautical Lab., Inc., Buffalo.

TITANIUM BRAZING. FINAL REPORT [FOR] MARCH 19, 1951 TO OCTOBER 31, 1952. L. A. Yerkovich. Oct. 31, 1952. 44p. Contract NOn(s)-51-294-c. (AD-38719)

An investigation was conducted to survey materials and methods that may be suitable for brazing titanium. It is shown that oxyacetylene torch, furnace and salt bath brazing techniques as presently practiced can be applied to braze this metal providing a suitable flux is incorporated in the brazing processes. Because available fluxes limit brazing from about 1100 to 1500°F, evaluation of joint properties was limited to aluminum and silver-base brazing alloys with melting points in that range. Initial studies using various aluminum and silver-base brazing alloys revealed the existence of brittle compounds formed during brazing which are believed to be one of the main causes of the erratic strengths found in single lap joint evaluation. In direct shear failure such as is encountered in double lap joints, these compounds seem to have less effect on the joint strength. Further investigation to reduce the influence of this brittle phase indicates that a very rapid brazing technique results in fairly reliable single lap joints which exhibit good fatigue and impact resistance. Data on joint strength, joint design, stress-rupture at 600 and 800°F, fatigue, and impact properties are presented for several selected brazing alloys. (auth)

**4794 NACA-TN-3444**

Lewis Flight Propulsion Lab., Cleveland.

FRICITION, WEAR, AND SURFACE DAMAGE OF METALS AS AFFECTED BY SOLID SURFACE FILMS. Edmond E. Bisson, Robert L. Johnson, Max A. Swikert, and Douglas Godfrey. [Feb. 10, 1955]. 61p.

A summation is presented of NACA results obtained from friction and wear investigations from 1946 to 1954. The results are consistent with theoretical predictions that solid surface films of low shear strength can serve to reduce both friction and surface damage. Metallic oxides can have very marked effects. Wear studies show that the ability of materials to form surface films is an important factor in wear. Solid lubricants (MoS<sub>2</sub> and graphite) are beneficial under severe operating conditions, including temperatures approaching 1000°F; both materials are, however, subject to oxidation at these temperatures. (NACA abst.)

**4795 NP-5633**

Metallurgical Advisory Committee on Titanium.

MINUTES OF TITANIUM SYMPOSIUM ON HEAT TREATING AND ALLOYING HELD AT BATTELLE MEMORIAL INSTITUTE, COLUMBUS, OHIO [ON] DECEMBER 7 AND 8, 1954. 60p.

Summaries of papers given at the symposium are pre-

sented. Among the topics discussed are effects of heat treatment and influence of interstitial elements on the mechanical properties of titanium alloys and phase transformations in solid solutions of the alloys. (C.W.H.)

**4796 NP-5635**

Battelle Memorial Inst., Columbus, Ohio.

A METALLURGICAL STUDY OF MOLYBDENUM. QUARTERLY STATUS REPORT NO. 8 COVERING THE PERIOD FEBRUARY 1, 1951 TO APRIL 30, 1951. May 1, 1951. 89p. Contract N9onr 82100, T. O. 1.

Progress is reported in identification of elements which impair the ductility of cast Mo by ascertaining which elements are reduced in concentration by the vacuum-fusion method; the preparation of samples of high-purity Mo by the reduction of Mo pentachloride; determination of arc-melting characteristics of various Mo alloys; high-temperature, creep-rupture testing of Mo from various sources; determinations of the effect of ambient atmosphere on the creep-rupture properties of Mo; procedures for measuring the solubility of O in Mo; a comparison of the ductility of as-cast high-purity Mo and wrought powder-metallurgy Mo; and investigations of which elements cause aging in Mo. (C.H.)

**4797 NP-5636**

Battelle Memorial Inst., Columbus, Ohio

A METALLURGICAL STUDY OF MOLYBDENUM. SUMMARY REPORT COVERING THE PERIOD MARCH 15, 1949 TO JULY 15, 1951 AND QUARTERLY REPORT NO. 9 COVERING THE PERIOD MAY 1, 1951 TO AUGUST 1, 1951. Aug. 1, 1951. 102p. Contract N9onr-82100, T. O. 1.

Results are summarized from studies on methods for improving the ductility of Mo, with emphasis on room-temperature ductility of weldments; measurement of the high-temperature mechanical properties of Mo and its alloys; and the improvement of the high-temperature oxidation resistance of Mo and Mo alloys. (For preceding period see NP-5635.) (C.H.)

**4798 NP-5637**

Battelle Memorial Inst., Columbus, Ohio.

A METALLURGICAL STUDY OF MOLYBDENUM. QUARTERLY STATUS REPORT NO. 13 COVERING THE PERIOD JUNE 1, 1952 TO AUGUST 31, 1952. Sept. 1, 1952. 102p. Contract N9onr-82100, T. O. 1.

Progress is noted on the following investigations: effect of impurity addition on the ductility of molybdenum; preparation of molybdenum by arc melting; welding characteristics and creep of Mo-Ti alloys; effect of preferred crystallographic orientation on the creep properties of molybdenum; oxidation resistance of molybdenum alloys; and analysis of molybdenum by the vacuum-fusion method. (For preceding period see NP-4572.) (C.W.H.)

**4799 NP-5638**

Battelle Memorial Inst., Columbus, Ohio.

A METALLURGICAL STUDY OF MOLYBDENUM. QUARTERLY STATUS REPORT NO. 14 COVERING THE PERIOD SEPTEMBER 1, 1952 TO NOVEMBER 30, 1952. Dec. 1, 1952. 83p. Contract N9onr-82100, T. O. 1.

Progress is noted on the following investigations: room-temperature ductility of molybdenum including the effect of impurity addition, solid-state purification process, and preparation of Mo-Ti and Mo-Th alloys; high-temperature creep-rupture testing of Mo-Ti alloys; and improvement



of the vacuum-fusion analytical method. (For preceding period see NP-5637.) (C.W.H.)

#### 4800 NP-5639

Battelle Memorial Inst., Columbus, Ohio.

A METALLURGICAL STUDY OF MOLYBDENUM. QUARTERLY STATUS REPORT NO. 15 COVERING THE PERIOD DECEMBER 1, 1952 TO FEBRUARY 28, 1953. Feb. 28, 1953. 91p. Contract N9onr-82100, T. O. 1.

Progress is reported in the study of factors affecting the room-temperature ductility of Mo and Mo alloys and on methods of improving this ductility, especially in weldments. (For preceding period see NP-5638.) (C.H.)

#### 4801 NP-5648

Rensselaer Polytechnic Inst., Troy, N. Y.

[DETERMINATION OF THE NOTCH SENSITIVITY OF WELD HEAT-AFFECTED ZONES IN VARIOUS ALLOYS]. INTERIM REPORT NO. 4. NOTCH SENSITIVITY OF THE WELD HEAT-AFFECTED ZONES IN TWO 7%Mn TITANIUM ALLOYS CONTAINING 0.14%C AND 0.07%C. Ernest F. Nippes and John M. Gerken. Mar. 1955. 38p. Contract DA-30-115-ORD-490.

Two 7% Mn-Ti alloys, differing in carbon content, were studied to determine the effects of the various weld thermal cycles and percentage carbon on the notch-toughness of the heat-affected zones. The individual thermal cycles for an energy input of 50,000 joules per inch using  $\frac{1}{2}$ -inch titanium alloys plate with no preheat were reproduced in Charpy V-notch impact specimens using a time-temperature controller. A supplementary study of the continuous cooling transformation of this alloy was made for a wide range of cooling rates. (auth)

#### 4802 RAE-TN-MET-197

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

THE TENSILE PROPERTIES OF D.T.D. 546 AND D.T.D. 687 AFTER HEATING AT ELEVATED TEMPERATURES. May 1954. 6p. (AD-38847)

The tensile properties of the duralumin alloy D.T.D. 546 and the aluminum-zinc-magnesium alloy D.T.D. 687 after heating at various temperatures up to 300°C for periods ranging from 5 sec to 1000 hr were determined. At temperatures of about 125°C the D.T.D. 687 alloy shows a greater loss of proof stress and ultimate tensile stress than the D.T.D. 546 alloy. (C.W.H.)

#### 4803 RAE-TN-MET-205

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

THE SLIP BAND EXTRUSION EFFECT IN COLD ROLLED SUPER PURITY ALUMINIUM. C. A. Stubbington and P. J. E. Forsyth. Oct. 1954. 8p.

It has been found that by cold rolling pure aluminum to a suitable degree, a slip band extrusion effect can be produced by subsequent fatigue stressing. This effect has been shown to be due to local recrystallization producing soft regions along slip striations and it analogous to the soft regions produced in aluminium-4% copper by accelerated over-aging under the action of fatigue stresses. (auth)

#### 4804 U-8710

Battelle Memorial Inst., Columbus, Ohio.

FUNDAMENTAL INVESTIGATION OF THE CAUSES OF CRACKING IN WELDS AND ADJACENT PARENT METAL. SUMMARY REPORT. A. J. Williams, R. D. Williams,

and C. B. Voldrich. Mar. 31, 1949. 50p. Contract N5-ori-111, T. O. 1.

Studies of the effects of sulfur and phosphorus additions on weld-metal cracking were completed. Thermal expansion and contraction tests, solidus-liquidus temperature-range determinations, and hot-shortness tests were carried out on several high-temperature alloys, electrode core-wire alloys, and weld metals. (C.W.H.)

#### 4805 U-22817

Battelle Memorial Inst., Columbus, Ohio.

A METALLURGICAL STUDY OF MOLYBDENUM. QUARTERLY STATUS REPORT NO. 11 COVERING THE PERIOD NOVEMBER 1, 1951 TO FEBRUARY 29, 1952. Mar. 1, 1952. 162p. Contract N9onr-82100, T. O. 1.

Progress is noted on the following investigations: room-temperature ductility of Mo including preparation of Mo by the vacuum-fusion method and the solid-state diffusion method, effect of addition of impurities, and rolling of Mo; and high-temperature oxidation resistance of Mo alloys. (For preceding period see U-23704.) (C.W.H.)

#### 4806 U-23704

Battelle Memorial Inst., Columbus, Ohio.

A METALLURGICAL STUDY OF MOLYBDENUM. QUARTERLY STATUS REPORT NO. 10 COVERING THE PERIOD AUGUST 1, 1951 TO OCTOBER 31, 1951. Nov. 1, 1951. 115p. Contract N9onr-82100, T. O. 1.

Progress is reported on studies of the relationship between the ductility and purity of commercial grade Mo; the improved ductility of vacuum-fusion-purified Mo over that of commercial Mo, indicating the importance of residual elements; the purification of Mo by heating solid rod at high temperatures in vacuum; elements adversely affecting the ductility of Mo and the limits of tolerance for such elements; methods for the spectrographic analysis of Mo; the specific effects of N and of O on the room-temperature ductility of Mo; the welding of Mo; and high-temperature properties of Mo and its alloys. (For preceding period see NP-5636.) (C.H.)

#### 4807 WAD-1774

Curtiss-Wright Corp. Wright Aeronautical Div., Wood-Ridge, N. J.

PROGRESS REPORT ON THE HEAT TREATMENT AND EVALUATION OF COMMERCIALY PRODUCED TITANIUM BASE ALLOYS. L. Luini and E. Lee. Oct. 14, 1953. 55p. Contract AF33(038)-23302. (AD-38656)

Isothermal transformation studies were conducted on the commercial alloys MST-3Al-5Cr, RC-130A, and RC-130B. The structures observed consisted of  $\alpha$ - $\beta$  weave structures at high temperatures and various types of Widmanstätten structure at the lower temperatures. The study of short transformation times was limited mostly to the  $\alpha$ - $\beta$  structure. Under certain conditions age hardening was observed during isothermal transformation treatments. (auth)

#### 4808 WADC-TR-52-232

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

ELECTRODEPOSITION OF TITANIUM FROM AQUEOUS SYSTEMS. Ernest J. Breton. Dec. 1952. 29p. (AD-2163)

A survey of published and unpublished literature on the electrodeposition of titanium was made. Efforts to electro-



deposit titanium fell into three main categories—electrodeposition from fused salts, electrodeposition from organic media, and electrodeposition from aqueous systems. The survey indicated that additional studies into electrodeposition from aqueous systems was warranted before concentrating on fused salt or organic systems. High pH, low pH, and alloy aqueous baths were investigated. The most promising results were obtained from an ammoniated titanium catanol system operating at a low pH. A discussion of the theoretical aspects of electrodepositing titanium from aqueous systems is included. (auth)

#### 4809 WADC-TR-53-465

National Research Corp., Cambridge, Mass.  
[MATERIALS ANALYSIS AND EVALUATION TECHNIQUES]. PREPARATION OF HOMOGENEOUS OXYGEN BEARING IODIDE TITANIUM SPECIMENS. Rodger D. Veneklasen. Feb. 1955. 23p. Contract AF 33(616)-2041.

Five 5-pound ingots have been alloyed, melted, and fabricated to produce the homogeneous oxygen-bearing iodide purity titanium specified in the contract. Chemical analyses for the interstitial elements and tungsten have been made on the ingots. Oxygen and hydrogen analyses have been made by vacuum fusion analytical methods. Analytical results are close to intended oxygen compositions and show the individual samples to be uniform and homogeneous within the limits of accuracy of the analytical methods. These analyses further show the interstitial elements to be lower than the limits set in the contract. The oxygen alloys were to have nominal compositions of 0.1, 0.2, 0.5, 1.0% with one additional ingot serving as a blank. It is believed that the procedure used for obtaining uniform oxygen content is reliable and accurate and it will be applied to other research work now in progress and requiring uniform additions of oxygen to Ti and Ti alloys. It is anticipated that further research applications will be forthcoming requiring controlled additions of oxygen, nitrogen, or carbon to metals requiring cold mold melting. (auth)

#### 4810 WAL-401/109-29

Michigan. Univ., Ann Arbor. Engineering Research Inst. [INVESTIGATION OF MACHINABILITY OF TITANIUM-BASE ALLOYS]. REPORT NO. 29. MACHINABILITY OF TITANIUM ALLOYS RC-110A AND 3Al-5Cr. L. V. Colwell. Apr. 1955. 86p. Contract DA-20-018-ORD-11918.

Numerous laboratory studies were made with both alloys. The RC-110A alloy was investigated as to its machining properties in milling, turning, tapping, broaching, conventional drilling, deep-hole drilling, and band-sawing. Similar observations were made for the 3Al-5Cr alloy except for deep-hole drilling. Both RC-110A and 3Al-5Cr titanium alloys demonstrate identically the same qualitative machining characteristics as all previously tested alloys with the exception of RC-130B, which was somewhat unique as emphasized in previous reports. (L.T.W.)

#### 4811 AEC-tr-2146

SELECTIVITY IN THE FORMATION OF FATIGUE CRACKS DURING THE WORKING OF STEEL IN A CORROSIVE MEDIUM. (Pro Vibirnist' v Utvorenni Trishchin Vtomi pri Roboii Stali u Koroziynomu Seredovichchi). G. V. Karpenko. Translated by S. Reiss from *Dopovidi Akad. Nauk Ukr. R.S.R.*, 112-15(1951). 5p. ADSORPTIVE BEGINNING OF THE CORROSIVE FATIGUE OF METALS. (Adsorbtsiini Pochatok Koroziinoi Vtomi Metaliv). G. V. Karpenko. Translated by S. Reiss. *Ibid.* 116-19(1951). 7p.

#### 4812

HOW IMPORTANT IS HYDROGEN EMBRITTLEMENT IN COLD-WORKED MILD STEEL? N. J. Grant and J. L. Lumsford (Massachusetts Inst. of Tech., Cambridge). *Iron Age* 175, No. 22, 92-4(1955) June 2.

A cold-worked mild steel (SAE 1020) can be embrittled permanently through hydrogen absorption. The hot-rolled product, however, retains ductility when subjected to the same conditions. (auth)

#### 4813

HAND BOOK ON TITANIUM. I. Heinrich K. Adenstedt. Available from OTS as PB-111631, \$3.00.

Information has been collected on specific properties and procedures of titanium by literature survey and by personal contact with the proper persons and institutions. The data have been evaluated and are condensed in this report. The three major sections of titanium technology covered are: production, physical metallurgy, and properties. (auth)

#### 4814

THE THEORY OF FATIGUE FRACTURE OF METALS. Takeo Yokobori (Univ. of Tokyo). *J. Phys. Soc. Japan* 10, 368-74(1955) May.

After limit of strain hardening, fatigue crack was assumed to form as a result of large tensile stress by a piled-up group of dislocations plus externally applied tensile stress component, with the aid of other stress concentration factor associated with the obstacle or inclusion itself. Nucleation theory was applied to the initiation of the crack. The theoretical S-N curve is in quantitative agreement with the data. The scatter of the number of cycles for fracture, which is an inherent characteristic of fatigue fracture, is, mostly if not wholly, explained as a stochastic phenomenon associated with nucleation process of the fatigue crack. The theoretical temperature dependence of fatigue strength is in fairly agreement with the data in literature. (auth)

#### 4815

STRUCTURE OF THE  $\omega$ -PRECIPITATE IN TITANIUM-16 PER CENT VANADIUM ALLOY. J. M. Silcock, M. H. Davies, and H. K. Hardy (Fulmer Research Inst., Stoke Poges, Bucks, England). *Nature* 175, 731(1955) Apr. 23.

The structure of the  $\omega$ -phase of the titanium-16% vanadium alloy has been determined by means of x-ray diffraction. The relationship between the  $\omega$ -phase and the  $\beta$ -phase of the Ti-V alloy is discussed. (C.W.H.)

#### 4816

DETERMINATION OF SUB-STRUCTURES IN METAL SINGLE CRYSTALS BY MEANS OF X-RAYS. H. Lambot, L. Vassamillet, and J. Dejace (Univ. of Liege, Belgium). *Acta Met.* 3, 150-6(1955) Mar. (In French)

The possibility of detecting a substructure in metal single crystals by means of an x-ray diffraction technique originally proposed by the authors is discussed in detail. The method is capable of revealing essentially perfect subgrains whose size is of the order of tens of microns and whose mutual disorientation is at least of the order of one minute of arc. The study of aluminum monocrystals (99.99% and 99.95%) deformed by a few per cent in tension has shown that one part of the matrix is fragmented into domains possessing a high internal perfection while the rest gives a diffuse background in the Bragg reflections. The effect of the heat treatments is as follows: (1) The diffuse background disappears progressively below about 450°C (pure aluminum) and about 550°C (99.95% aluminum); (2) above these temper-



atures the growth of certain almost perfect subgrains is the outstanding phenomenon. (auth)

#### 4817

EFFECT OF GRAIN BOUNDARIES UPON PORE FORMATION AND DIMENSIONAL CHANGES DURING DIFFUSION. R. W. Balluffi and L. L. Seigle (Sylvania Electric Products, Inc., Bayside, N. Y.) Acta Met. **3**, 170-7(1955) Mar. (In English)

A study has been made of the effects of grain boundaries and specimen thickness upon pore formation and dimensional changes which occur when zinc is diffused out of polycrystalline alpha brass sheets. The results are consistent with the viewpoint that the outward flux of zinc produces a supersaturation of vacancies which may either precipitate as pores or else be absorbed at sinks within the alloy causing various dimensional changes. In thin sheets  $\sim 0.0015$  cm in thickness it was found that vacancies were eliminated at sinks within the grains (presumably at dislocations) and also at grain boundaries. The destruction of vacancies at the boundaries tended to prevent the nucleation of porosity near the grain boundaries and caused a contraction of the specimen normal to the plane of the boundary. In thicker sheets, however, many grain boundaries acted as preferred sites for void formation and subsequent cracking. This change in the behavior of the boundaries is explained by differences in the magnitude of internal stresses which are produced in the various sheets by the restraining effect of the bulk of the specimen upon shrinkage in the diffusion zone. (auth)

#### 4818

CALORIMETRIC MEASUREMENTS DURING PRECIPITATION IN A GOLD-NICKEL ALLOY. J. Nyström (Royal Inst. of Tech., Stockholm, Sweden and North Carolina State Coll., Raleigh). Acta Met. **3**, 182-5(1955) Mar. (In English)

An apparatus was designed and built for measurements of heat evolved at high temperatures. The heat of precipitation between 400 and 500°C in a gold-nickel alloy with 26 atomic per cent nickel was determined. The results are compared with the heat of precipitation as calculated from the two-phase boundary assuming the entropy of mixing to be the same as for an ideal solution. The results are also compared with those calculated from the heat of mixing obtained elsewhere from measurements of electrolytic potentials. The kinetics of the transformation were also studied. (auth)

#### 4819

DEFORMATION PROCESSES IN ZIRCONIUM. E. J. Rapoport (Massachusetts Inst. of Tech., Cambridge). Acta Met. **3**, 208(1955) Mar. (In English)

#### 4820

EFFECT OF IRRADIATION UPON BERYLLIUM COPPER. J. T. Richards (Penn Precision Products, Inc., Reading, Penna.). Acta Met. **3**, 211-12(1955) Mar. (In English)

## PHYSICS

#### 4821 AERE-EL/R-1564

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME MEASUREMENTS OF INSULATION RESISTANCE WITH PARTICULAR REFERENCE TO WAFER SWITCHES. R. L. Elliott and D. J. Wilson. Nov. 20, 1954. 24p.

Some measurements of insulation resistance are given, and the factors which may affect such measurements for

values greater than  $10^4$  ohms are described. The performance of siliconed ceramic wafer switches is described, and the possible use of Mycalex for this purpose is discussed. (auth)

#### 4822 KAPL-1303

Knolls Atomic Power Lab., Schenectady, N. Y.  
A HIGH-TEMPERATURE X-RAY FURNACE FOR THE GENERAL ELECTRIC X-RAY SPECTROMETER. H. T. Sumsion and H. G. Sowman. Apr. 1, 1955. 18p. Contract W-31-109-Eng-52.

A furnace has been designed and constructed for use with the General Electric x-ray diffraction spectrometer which permits the x-ray investigation of materials at elevated temperatures under vacuum or selected atmospheres. Using a heating element of Pt-20 wt % Rh wire wound on a ceramic core, sample temperatures up to 1200°C can be obtained easily and held for prolonged periods. With a W coil heating element, sample temperatures up to 1800°C are easily reached. Application of the furnace is illustrated by its use in high-temperature phase transformation studies of a Mn-Ni alloy and of  $ZrO_2$ . Typical spectrometer patterns are shown. (auth)

#### 4823 AEC-tr-2134

HYDROGEN AT HIGH TEMPERATURES. (Wasserstoff Bei Hohen Temperaturen). Irene Bredt. Translated from Z. Naturforsch. **6a**, 103-22(1951). 14p.

The possible use of hydrogen as an operating medium in high-temperature heat engines was investigated. Several thermodynamic data for hydrogen between 1000 and 10,000°K at pressures between  $10^{-3}$  and  $10^6$  atmospheres are reported. Explanations are given of the heating of hydrogen in the boiler of the engine and the subsequent expansion of hydrogen during discharge. (C.W.H.)

#### 4824 AERE-Lib/Trans-435

EVALUATION OF MIXING-PLANT WITH THE HELP OF STATISTICAL METHODS. K. Stange. Translated by A. H. Gillieson from Chem. Ing. Tech. **26**, 150-5(1954). 11p.

#### 4825

ENERGY LEVELS OF ATOMS OF ATOMIC NUMBER BELOW 70. Y. Cauchois (Faculté des Sciences, Paris). J. phys. radium **16**, 253-62(1955) Apr. (cf. J. phys. radium **13**, 113(1952)). (In French)

A table of atomic energy levels is presented for atomic number 3 to 69 inclusively, calculated by means of the characteristic x frequencies. Up to atomic number 37 inclusively, the transition frequency which serves at the basis of the calculations is that of the  $L_{III}$  discontinuity. Beyond, the zero of energies change slightly, since the base is taken as the frequency of the K absorption discontinuity. (tr-auth)

#### 4826

THE HYPOTHESIS OF VACUUM POLARIZATION IN CLASSICAL ELECTROMAGNETISM. Emile Durand (Faculté des Sciences de Toulouse). J. phys. radium **16**, 262-70(1955) Apr. (In French)

It is shown that it is possible to consider a vacuum as a polarized medium. At all points where the electric field is  $\vec{E}$  and the magnetic induction  $\vec{B}$ , the electric polarization density  $\vec{P}$  and magnetic density  $\vec{M}$  are given by  $\vec{P} = -\epsilon_0 \vec{E}$ ,  $\vec{M} = \vec{B}/\mu_0$ . In isotropic media,  $\epsilon_0$  and  $\mu_0$  are replaced by  $\epsilon$  and  $\mu$ . A modified formulation of electromagnetism results without changing measurable quantities. In particular, a polarization potential is defined for a point charge at rest



or in motion, for a linear current, etc., and these potentials are shown to possess physical significance. (tr-auth)

**4827**

MEASUREMENTS ON RADIOACTIVE DUSTS OVER CALCUTTA. Santimay Chatterjee, A. P. Patro, Binayak Basu, R. L. Bhattacharyya, and Fazle Hosain (Institute of Nuclear Physics, Calcutta, India). Science and Culture (India) **20**, 399-401(1955)Feb.

A brief report of the measurements of the radioactivity of rain water samples collected in Calcutta from April 29 till the middle of July 1954, is presented. Measurements of energy and half lives indicated that the dusts originated from nuclear explosions. (L.T.W.)

**4828**

DATING A NUCLEAR EXPLOSION. Santimay Chatterjee, A. P. Patro, Binayak Basu, R. L. Bhattacharyya, and Manoj K. Banerjee (Institute of Physics, Calcutta, India). Science and Culture (India) **20**, 403-4(1955) Feb.

A method is proposed for dating nuclear explosions from the composite beta-decay curves of the radioactive dusts. (L.T.W.)

**4829**

THE HANDLING OF RADIOACTIVE MATERIALS. II. K. W. Bagnall and W. T. Spragg (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics **6**, 125-9, 33(1955) May.

Techniques and apparatus for the safe handling of  $\alpha$ ,  $\beta$ , and  $\gamma$  active materials are reported. (L.T.W.)

## AEROSOLS

**4830** AFCRC-TR-54-257

Montreal. Univ.

[STUDIES ON THE MECHANISM OF NUCLEATION].

FINAL REPORT. Pierre R. Gendron, May 31, 1954. 83p. Contract AF19(122)-380. (AD-39644)

Five papers are included in the report. The Use of a Diffusion Cloud Chamber to Characterize Condensation Nuclei. A diffusion cloud chamber was modified so that the temperature gradient could be controlled, thereby enabling the degree of supersaturation to be calculated. The effectiveness of various inorganic nuclei in causing condensation was studied. The construction and operation of the cloud chamber is described. Production of Monodispersed Nuclei and Measurement of their Size. The production of an aerosol of dibutyl phthalate using sulfuric acid as the nucleating agent is described. Variation of the acid concentration produced only a slight variation in the size of the nucleus corresponding to a similar variation in the partial vapor pressure of  $H_2SO_4$ . A Study of the Production of Monodispersed NaCl Nuclei. An investigation is described of the influence on particle formation of temperature of the nuclei source, volume of carrier gas, and terminal gradient to which particles were submitted. The results enable the production of particles of known size and monodispersity. Heat of Adsorption Measurements. A new micro-calorimeter is described which can detect the evolution of 25 microcalories of heat. Preliminary experiments were performed using a sample of  $TiO_2$  of known surface area and water vapor. A definite break in the adsorption curve was obtained, indicating the completion of the monolayer. Study of the Size Distribution of NaCl Nuclei. An electrical charging and precipitating device was used to collect NaCl nuclei generated by a hot coil. The particles were

collected on grids and examined in the electron microscope. It was found that the stream of nuclei was separated into groups of particles whose size depended on the distance traveled in the collector. Factors influencing microcrystal formation were studied by varying experimental conditions. (M.P.G.)

**4831** NYO-1594

Harvard Univ., Boston. Air Cleaning Lab.

ELECTROSTATIC MECHANISMS IN FIBER FILTRATION OF AEROSOLS. A[ugust] T. Rossano, Jr. and Leslie Silverman. May 11, 1955. 60p. Contract AT(30-1)-841.

A detailed evaluation is presented of the magnitude of the electrostatic factor in the efficiency of aerosol filtration through fibrous filters. Data are presented from a series of tests in which methylene blue spheres were used as the test aerosol and all collection parameters, excepting electrostatic extraction, were maintained constant through the test series. Aerosol charge measurements were based on the Faraday Ice Pail principle. Test equipment is described, and results are presented graphically. Quantitative information is included on the role of electrostatics as a removal mechanism in aerosol filtration. (C.H.)

## COSMIC RADIATION

**4832** AERE-N/R-1550

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE SECOND MAXIMA IN THE TRANSITION CURVE OF COSMIC RAY SHOWERS. J. B. Harding and P. R. Robinson. Nov. 1954. 23p.

Four trays of Geiger counters, separated by a lead absorber, were arranged to detect showers produced by charged particles. Slight indications of an extended secondary maximum in the transition curve disappeared when the apparatus was lifted well above the floor. An explanation is presented. This work is compared with that of observers who have presented evidence for a sharp secondary maximum. An explanation of the disagreement can only be obtained in terms of an unknown particle with unusual properties. Such a hypothesis must therefore be regarded as very tentative. (auth)

**4833**

MEASUREMENTS OF THE MOMENTUM SPECTRUM OF  $\mu$ -MESONS AT SEA LEVEL. I. THE MOMENTUM RANGE  $5 \times 10^8$  EV/C TO  $2 \times 10^{10}$  EV/C. B. G. Owen (Univ. of Manchester) and J. G. Wilson (Univ. of Leeds). Proc. Phys. Soc. (London) **A68**, 409-18(1955) May.

The  $\mu$ -meson momentum spectrum near sea level in  $57^\circ$  N geomagnetic latitude has been measured for strictly defined angles of collection near the vertical direction. Results are given, covering the momentum range  $5 \times 10^8$  ev/c  $< p < 2 \times 10^{10}$  ev/c, which are based on the measurement of about 60,000 trajectories. (auth)

**4834**

A NEW EXAMPLE OF A  $\chi$  MESON IN PHOTOGRAPHIC EMULSIONS. Violette Fouche and Jacques Trembley. Compt. rend. **240**, 1638-40(1955) Apr. 18 (In French)

## CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

**4835** AEC-tr-2137

ON STATES OF CONDUCTION ELECTRONS IN IDEAL



**HOMOPOLAR CRYSTALS.** M. F. Deigen and S. I. Pekar. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 21, 803-8 (1951). 12p. Available from Morris D. Friedman ([Trans. No.] D193580), West Concord, Mass.

Local deformation of crystals by an electron field and the influence of steady electron localization near this deformation are considered. The theory of local electron states in crystals as developed by Frenkel, Tarm, Landau, Pekar, Deigen, Blakhintzev, Sokolov, and others is summarized. Factors affecting electron conductivity in ideal homopolar dielectrics are discussed. (C.H.)

**4836** AEC-tr-2138

**ON THE ENERGY SPECTRA OF ELECTRONS IN POLAR CRYSTALS.** S. V. Tyablikov. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 23, 381-91(1952) 20p. Available from Morris D. Friedman ([Trans. No.] D193559), West Concord, Mass.

There is studied the energy spectrum of an electron in an ionic crystal taking into account the interaction of the electron with the polarization it produces. This spectrum, it appears, has a band character in which the band width depends essentially on the magnitude of the electron coupling with the lattice polarization; the location of the band center depends on it, to a lesser degree. (auth)

**4837** AEC-tr-2139

**ON THE ENERGY SPECTRA OF ELECTRONS IN POLAR CRYSTALS, II.** S. V. Tyablikov. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 26, 545-60(1954). 12p. Available from Morris D. Friedman ([Trans. No.] D193563), West Concord, Mass.

The form of the energy spectrum of an "excess" electron in a polar crystal has been studied, assuming that the electron interaction with the polarized oscillations has adiabatic character. The reasoning is carried out approximately analogously to the method of almost free electrons. (auth)

**4838** AEC-tr-2141

**REVIEW OF S. I. PEKAR'S "STUDY ON ELECTRON THEORY OF CRYSTALS", 1951.** S. V. Tyablikov. Translated from *Uspekhi Fiz. Nauk* 48, 447-51(1952). 12p. Available from Morris D. Friedman ([Trans. No.] D193566), West Concord, Mass.

The studies of S. I. Pekar and his pupils and colleagues, which develop the work of L. D. Landau and J. N. Frenkel, relative to the theory of semiconductors and dielectrics with ionic crystal lattices are summarized. The single electron problem and the behavior of an excess electron in ionic crystals are discussed. It is postulated that in ionic crystals an essential role is played by the interaction of the added electrons with the oscillations of the lattice and the polarization of the lattice by the field of the electron itself, and on these assumptions a theory is presented of electric and optical properties of crystals. (C.H.)

**4839** AEC-tr-2155

**PHOTOELECTRIC AND OPTICAL PROPERTIES OF SILVER HALIDE CRYSTALS.** E. K. Putseiko and P. V. Mel'dyar. Translated from *Zhur. Eksptl'. i. Teoret. Fiz.* 21, 341-9(1951). 9p. Available from Associated Technical Services (Trans. No. 64G5R), East Orange, N. J.

The spectral distribution of photoelectric sensitivity and light absorption has been studied in both irradiated and unirradiated crystals of AgBr and AgCl. The change in absorption by the crystals as a result of increased tempera-

tures has been studied as well. It has been shown that under the action of light of as a result of heating "atomic" centers appear which are analogous to F-centers in alkali halide crystals. (auth)

## INSTRUMENTS

**4840** AD-24127

Armed Services Technical Information Agency Reference Center, Library of Congress, Washington, D. C. A REPORT BIBLIOGRAPHY ON COMPUTERS; INCLUDING FIRE CONTROL COMPUTERS, FLIGHT CALCULATORS, MATHEMATICAL COMPUTERS, NAVIGATION COMPUTERS. (INCLUDES APPROXIMATELY 340 REFERENCES). Florence A. Clark, comp. Jan. 12, 1954. 30p. (ARC-854)

**4841** CARDE-291/53

Canada. Armament Research and Development Establishment, Valcartier, Que.

AN INSTRUMENT FOR LEAK DETECTION AND PRESSURE MEASUREMENT IN HIGH VACUUM SYSTEMS. Edouard S. Leger. Dec. 1953. 12p. (AD-39796)

An instrument is described for measuring gas pressure in the range  $10^{-1}$  to  $10^{-7}$  mm of mercury. At the higher pressures vacuum thermocouples are used and at the lower pressures ionization gages. Leaks are detected by spraying oxygen on the outside of the vacuum system and noting the decrease in electrons from a tungsten filament emitter in an ionization gage when it is operated as a saturated diode. Leaks are traced either by observing a meter or by means of the change in frequency of an audio-oscillator. To avoid damage an automatic cut-off is used to turn off the gages and diffusion pumps when the pressure reaches a pre-determined value. (auth)

**4842** ORNL-1865

Oak Ridge National Lab., Tenn. INSTRUMENTATION AND CONTROLS DIVISION SEMI-ANNUAL PROGRESS REPORT FOR PERIOD ENDING JANUARY 31, 1955. May 19, 1955. 23p. Contract W-7405-eng-26.

A memory device with a synchronously switched condenser has been developed to simulate transport lag for an analog computer. Other instruments developed include a liquid scintillation counter for  $C^{14}$ , a fission-chamber preamplifier that can be located up to 30 ft from the fission chamber, a decade-type scaler, creep-test instrumentation, a 20- $\mu$ sec variable delay circuit, an automatic data recorder, and a neutron dosimeter pulse integrator. Components from the analog computer facility have been used to replace the ballistic galvanometer for magnetic flux measurements. Auxiliary memory and parity checking systems are being installed in the ORACLE. A double-delay-line linear amplifier has been developed for use with scintillation spectrometers. Performance curves and a circuit diagram are presented. The performance of proportional counters at 1 mm pressure or less and the characteristics of a halogen-quenched Geiger counter were investigated. (For preceding period see ORNL-1768.) (M.P.G.)

**4843** UCRL-4485

California. Univ., Livermore. Radiation Lab. PRECISION ROTATING DEVICE FOR THE VACUUM-EVAPORATION COATING OF MODEL 100 OCTAGONAL MIRRORS. Alfred R. Taylor. Apr. 4, 1955. 8p. Contract W-7405-eng-48.



A device is described which was designed and constructed to coat an 8-faced mirror with an equal amount of material on each face. Aluminum, silver, gold, tin, and chromium as well as nonmetallic substances may be used as coating materials. A shutter interrupts the stream of evaporant to the mirror while the mirror is being rotated. When the mirror is stopped, the shutter opens long enough for a coating  $\sim 4 \times 10^{-6}$  in. thick to be applied. (M.P.G.)

#### 4844

ELECTRONIC COMPUTERS FOR THE BUSINESSMAN. John M. Carroll. *Electronics* 28, No. 6, 122-31(1955) June.

A brief description of the various types of electronic computers is presented. Tables of cost, availability, uses, technical characteristics, and performance are given for 38 computer models. (C.W.H.)

### MATHEMATICS

#### 4845 DP-101

Du Pont de Nemours (E. I.) and Co. Savannah River Lab., Augusta, Ga.

FLOATING-DECIMAL MATRIX INVERSION. F. M.

Trantham, Jr. Apr. 1955. 42p. Contract AT(07-2)-1.

The method of matrix inversion described in IBM Technical Newsletter No. 4 is adapted to the Heising Floating-Decimal General-Purpose Board for the IBM Card-Programmed Electronic Calculator, Model 412, 605. (auth)

#### 4846 KAPL-1333

Knolls Atomic Power Lab., Schenectady, N. Y.

ITERATIVE METHODS FOR SOLVING ELLIPTIC-TYPE DIFFERENTIAL EQUATIONS WITH APPLICATION TO TWO-SPACE-DIMENSION MULTIGROUP ANALYSIS. E. L. Wachspress. May 11, 1955. 65p. Contract W-31-109-Eng-52.

Various methods are discussed for solving elliptic-type differential equations. A broad coverage of many aspects involved in the solution of large systems of equations as applied to neutron-diffusion calculations is presented. An attempt is made to determine the optimum iterative technique for two-space-dimension multigroup calculations. (M.P.G.)

#### 4847 U-10895

Air Force, Washington, D. C.

BIBLIOGRAPHY ON LINEAR PROGRAMMING AND GAME THEORY. Robert Dorfman. May 22, 1950. 11p.

### MEASURING INSTRUMENTS AND TECHNIQUES

#### 4848 AERE-I/M-32

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE STATISTICS OF THE ADJUSTMENT AND COMPARISON OF COUNTERS. K. D. Outteridge. June 1954. 12p.

A theoretical justification is given for a criterion which has been proposed by other workers for comparing different counters and for determining the optimum values of the variable parameters of a single counter. The application and validity of this criterion are discussed with reference to the adjustment of a  $\gamma$  scintillation counter and to the comparison of a proportional counter with a Geiger counter for counting low-energy  $\beta$  particles. (auth)

#### 4849 UCLA-335

California. Univ., Los Angeles. Atomic Energy Project. THE USE OF AN AUTOMOBILE RADIO AS A POWER SUP-

PLY FOR A RADIATION DETECTOR. Frank C. Strebe. May 20, 1955. 11p. Contract AT-04-1-GEN-12.

This paper discusses two methods of using an automobile radio to supply the voltage necessary for the operation of a Geiger-Mueller tube radiation detector. (auth)

#### 4850 AERE-Lib/Trans-480

THE COUNTING OF IMPULSES REGISTERED ON A STEEL WIRE. T. Franzini and L. Musumeci. Translated by J. B. Sykes from *Nuovo cimento* (9) 7, 159-60(1950). 2p.

A device is described which makes it possible to increase the number of impulses per unit time registered by a radiation detection instrument. The impulses are recorded on a steel wire which can be made to run at a reduced speed in order to count the impulses. This method can not record such high frequencies as a system using demultiplication scales, but it has the advantage of conserving both the total number of impulses and their distribution as a function of time. The device can also be used to count impulses of exceptionally low frequency by recording them on wire running a reduced speed and counting with the wire running at a higher speed. (M.P.G.)

#### 4851 AERE-Lib/Trans-540

OBSERVATION OF TRACKS OF IONISING PARTICLES OF HIGH ENERGY FROM AN ACCELERATOR, USING A BUBBLE PROPANE CHAMBER. G. A. Blinov, Yu. S. Krestnikov, and I. I. Pershin. Translated by J. B. Sykes from *Doklady Akad. Nauk S.S.S.R.* 99, 929-30(1954). 3p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-2422.

#### 4852

METHOD FOR COUNTING TRITIUM IN TRITIATED WATER. James Wing and W. H. Johnston (Purdue Univ., Lafayette, Ind.). *Science* 121, 674-5(1955) May 6.

A simple, inexpensive method is described for counting tritium in tritiated water. The tritium is converted to tritium hydride, which is measured by a one-step conversion to acetylene using calcium carbide. A Geiger counter is used for counting a self-quenching mixture of acetylene plus argon. The method is reported to give good reproducibility. (C. H.)

#### 4853

CORRECTION FACTORS FOR COMPARING ACTIVITIES OF DIFFERENT CARBON-14 LABELED COMPOUNDS ASSAYED IN FLOW PROPORTIONAL COUNTER. M. L. Karnovsky, J. M. Foster, L. I. Gidez, D. D. Hagerman, C. V. Robinson, A. K. Solomon, and C. A. Villee (Harvard Medical School, Boston, Mass.). *Anal. Chem.* 27, 852-4(1955) May.

A comparison has been made of the activities of several organic compounds counted as such or as barium carbonate obtained after combustion. In the windowless gas-flow counter, under the conditions specified, the relevant correction factors are much smaller than those reported in the literature for end-window Geiger counters. (auth)

#### 4854

A PHOTO-MULTIPLIER TUBE FOR SCINTILLATION COUNTING. R. Champeix, H. Dormont, and E. Morilleau (Laboratoires d'Electronique et de Physique appliquees, Paris). *Philips Tech. Rev.* 16, 250-7(1955) Mar.

A scintillating crystal in conjunction with a photomultiplier tube for investigations of radioactive radiations gives a measuring system of high sensitivity (low noise-level), short dead-time ( $10^{-7}$  sec.), and of linear response (output-current pulse  $\propto$  to energy of incident particle). These properties of

the system make it suitable for the spectrometry of ionizing radiations. Some of the properties necessary in the scintillating material are described, and the superiority of the photomultiplier tube to the combination photoelectric cell + amplifier as regards noise-characteristics is explained. A photomultiplier tube developed by the Laboratoires d'Electronique et de Physique appliquées in Paris is described. This tube contains ten stages of secondary emission, giving an over-all current-amplification of 500,000 times. To preserve a low inherent noise-level, it is necessary to reduce all parasitic emission (e.g. thermionic or "cold" emission) in the tube as far as possible. It is shown that the resolving time of the scintillation counter-photomultiplier combination is governed mainly by the time-constants of the scintillating crystal and the output circuit. The construction of the tube is described and it is shown that the tube is suitable for spectrometry. (auth)

#### 4855

THEORETICAL STUDY OF THE OPERATION OF THE LAST STAGE OF A PHOTOMULTIPLIER. P. Leuba. J. phys. radium **16**, 296-303(1955) Apr. (In French)

A relationship is sought between the shape of a pulse produced in the last dynode of a photomultiplier tube and the electrons emitted by the preceding dynode. The equations of motion of the charges in the space between the two dynodes were studied for a simple geometry, where valid conditions approximating the solution of the problem are deduced. The solutions are also valid for the general case. An experimental method is indicated which, in certain cases, permits an estimation of the duration of a luminous pulse excited in a crystal by radiation, and to obtain information on its shape. It is also possible to determine the conditions for linear operation of the last stage. (tr-auth)

#### 4856

MOUNTING A NaI(Tl) CRYSTAL IN A SEALED BOX. B. Mougin. J. phys. radium **16**, 339(1955) Apr. (In French)

Techniques for cleaning, polishing, and mounting a NaI crystal are described. Handling of the crystals is done in a dry box containing  $P_2O_5$  and a  $N_2$  atmosphere. The method provides for mounting the crystal in Al cylinders. (K.S.)

#### 4857

DETERMINATION OF TOTAL CARBON AND ITS RADIO-ACTIVITY. II. REDUCTION OF REQUIRED VOLTAGE AND OTHER MODIFICATIONS. F. Marott Sinex, John Plazin, D. Clareus, W. Bernstein, Donald D. Van Slyke, and R. Chase (Brookhaven National Lab., Upton, N. Y.). J. Biol. Chem. **213**, 673-80(1955) Apr.

The substitution of a gas mixture (90% argon and 10% methane) for pure methane enables the proportional gas counter of Bernstein and Ballentine to be operated at 2100 v instead of 3800 v. A circuit diagram for a suitable pulse amplifier is given. The preparation of  $CO_2$ -free alkali and the transferring of  $CO_2$  during analyses are described. (C.W.H.)

### MESONS

#### 4858 AECU-3023

Princeton Univ., N. J. Palmer Physical Lab. and Naval Ordnance Lab., White Oak, Md.

A CLOUD CHAMBER INVESTIGATION OF CHARGED  $V$  PARTICLES—PROPERTIES OF THE CHARGED  $\theta$  MESON (thesis). COSMIC RAY GROUP TECHNICAL REPORT NO. 17. William Howard Arnold, Jr. May 2, 1955. 101p.

Sponsored by ONR and AEC under Contract N6ONR-270-II.

An experimental investigation of charged unstable particles is reported. The apparatus consisted of 2 Wilson cloud chambers operated simultaneously at an altitude of 10,600 ft. From photographs, 46 examples of charged heavy meson and hyperon decays were observed. The analysis of the data is described, and results are presented. On the basis of a lifetime analysis, it was concluded that the 17 two-body K-meson decays observed were mostly of the type  $\theta^+$ , with a ratio of  $K_\mu^+$  to  $\theta^+$  at production which is consistent with unity. The mass of the  $\theta^+$  particle was deduced to be  $953 \pm 18 m_e$  and the mean life  $4.8 \times 10^{-10} {}^{+2.2}_{-1.1}$  sec with 50% confidence. The data available at the present time on the properties of heavy mesons are summarized. (M.P.G.)

#### 4859 UCRL-2953

California. Univ., Berkeley. Radiation Lab.

$\pi^+$ -PHOTOMESON PRODUCTION FROM HYDROGEN, DEUTERIUM, HELIUM, AND CARBON (thesis). Gordon W. Repp. Apr. 12, 1955. 73p. Contract W-7405-Eng-48.

Hydrogen, deuterium, helium, and carbon were bombarded by the  $342 \pm 6$ -Mev bremsstrahlung beam of the Berkeley synchrotron and  $\pi^+$  mesons were observed at  $180^\circ \pm 3^\circ$  to the beam;  $\pi^+$  mesons were also observed from H and D at  $143^\circ \pm 6^\circ$ . At  $180^\circ$  the mesons were deflected out of the photon beam by means of a magnet. Detection was accomplished by stopping the  $\pi^+$  meson in a scintillator and detecting the positron from the  $\mu^+$ -meson decay by a coincidence with a gate triggered by the stopping  $\pi^+$ . Absolute cross sections were obtained by calibrating the scintillation counters with nuclear emulsions. The emulsions were exposed to mesons from H at  $180^\circ$  and from D at  $143^\circ$ . The  $\pi^-/\pi^+$  ratios were acquired from the  $143^\circ$  emulsion data. Energy distributions were obtained for  $\pi^+$  mesons from the targets at the angles described above. Excitation functions for  $\pi^+$  mesons from H at  $180^\circ$  and  $143^\circ$  are given for photon energies of 196 to 325 Mev. D-H ratios are given at  $180^\circ$  and  $143^\circ$ , and He-H and C-H ratios are given at  $180^\circ$ . (auth)

#### 4860 UCRL-2979

California. Univ., Berkeley. Radiation Lab.

MULTIPLE MESON PRODUCTION IN EMULSIONS EXPOSED TO THE BEVATRON BEAM (thesis). William Russell Johnson. May 3, 1955. 44p. Contract W-7405-eng-48.

Stacks of 600-micron Ilford G.5 stripped emulsions have been exposed to the internal beam of the Bevatron at three energies: 3.2, 4.8, and 5.7 Bev. Shower-particle production has been investigated at these energies. (A shower particle is defined as one whose grain density is less than 1.4 times minimum.) At each energy 114 events which had beam protons for primaries were found by area scanning. The average shower particle multiplicities per event were found to be  $0.94 \pm 0.09$ ,  $1.30 \pm 0.11$ . These results are compared with similar observations by cosmic-ray workers. The various theories of meson production are reviewed, and Fermi's calculations for Cosmotron energies have been extended to the energies of this experiment. Production differences in heavy and light nuclei are discussed and compared. (auth)

#### 4861

A CALIBRATION MEASUREMENT OF MULTIPLE SCATTERING OF SLOW  $\mu$ -MESONS BY THE CONSTANT SAGITTA METHOD. Shin-ichi Kaneko (Osaka City Univ., Japan). J. Phys. Soc. Japan **10**, 325-32(1955) May.



Multiple scattering observations have been carried out on 103 slow cosmic-ray  $\mu$  mesons coming to rest in G5 emulsions. The emulsions were coated, exposed, and processed at a depth of about 17 m.w.e. underground. It is shown that the constant sagitta scheme recommended by the Göttingen group gives satisfactorily constant mean sagittae with increasing residual range at least in the region of velocity  $0 \lesssim \beta \lesssim 0.46$ . Observations of 81  $\mu$  mesons are also described which were done by the scheme based upon the Williams theory of scattering and upon the range-energy relation given by Bradner et al. The error introduced by the use of schemes other than that of Göttingen is discussed. The results are compared with Glasser's calibration experiment on 101 artificially produced slow protons. (auth)

## NUCLEAR PHYSICS

### 4862

CHARGE INDEPENDENCE IN NUCLEAR PHYSICS. R. E. Marshak. *J. phys. radium* **16**, 325-34(1955) Apr. (In French)

Experimental evidence leading to the concept of charge independence in nuclear forces is presented. Ideas on energy levels in light nuclei and high-energy nucleon-nucleon scattering are considered. The theoretical relationship between charge independence for a meson-nucleon system and nuclear forces is outlined. Experimental work in favor of charge independence for a  $\pi$  meson-nucleon system is taken from phenomena of  $\pi$  meson-nucleon scattering, the production of  $\pi$  mesons in nuclei, and the photoproduction of mesons. The general significance of the hypothesis of charge independence is discussed. (tr-auth)

## NUCLEAR PROPERTIES

### 4863 UCRL-2970

California. Univ., Berkeley. Radiation Lab.  
DECAY SCHEMES AND NUCLEAR SPECTROSCOPIC STATES IN THE HEAVY-ELEMENT REGION (thesis). Frank Samuel Stephens, Jr. June 1955. 178p. Contract W-7405-eng-48.

Using principally a coincidence circuit coupled to a 50-channel pulse-height analyzer, a study of the radiations from the following isotopes was made:  $100^{254}$ ,  $99^{253}$ ,  $254$ ,  $Cf^{246}$ ,  $249$ ,  $250$ ,  $252$ ,  $Am^{239}$ ,  $243$ ,  $Np^{237}$ ,  $238$ ,  $U^{230}$ ,  $236$ ,  $Th^{228}$ ,  $228$ ,  $229$ ,  $230$ ,  $231$ ,  $Ac^{225}$ ,  $Ra^{222}$ ,  $224$ ,  $225$ ,  $226$ ,  $Fr^{221}$ ,  $Em^{218}$ ,  $At^{217}$ ,  $Po^{213}$ ,  $Bi^{213}$ ,  $Tl^{209}$ , and  $Eu^{154}$ . In most cases decay schemes or at least partial decay schemes were suggested. The data on the even-even isotopes were found to fit in well with the previously existing systematics except for a group of low-lying 1- states in the radium-thorium region. The information available on the five members of this group has been discussed in some detail. Regularities have been noted in the energy levels of odd mass nuclei in this region, and a preliminary systematics has been suggested. (auth)

### 4864 UCRL-2974

California. Univ., Berkeley. Radiation Lab.  
I. NEUTRON-DEFICIENT ISOTOPES IN THE NOBLE METAL REGION. II. CONVERSION ELECTRON SPECTRA OF SOME HEAVY ELEMENTS (thesis). Warren G. Smith. June 1955. 112p. Contract W-7405-eng-48.

I. A radiochemical study of some neutron-deficient nuclides in the noble metal region has been undertaken, and several new chains identified. The method used to establish genetic relationships was that of timed chemical

separations, where the parent activities are initially produced by cyclotron or linear accelerator bombardments. The following chains have been identified:  $A = 191$ ,  $Hg^{191} \xrightarrow{55 \text{ min}} Au^{191} \xrightarrow{3.0 \text{ hr}} Pt^{191} \xrightarrow{3.0 \text{ day}} Ir^{191}$ ;  $A = 189$ ,  $Hg^{189} \xrightarrow{\sim 20 \text{ min}} Au^{189} \xrightarrow{42 \text{ min}} Pt^{189} \xrightarrow{10.5 \text{ hr}} Ir^{189} \xrightarrow{11 \text{ day(?)}}$ ;  $Os^{189}$ ;  $A = 188$ ,  $Pt^{188} \xrightarrow{10.0 \text{ day}} Ir^{188} \xrightarrow{41 \text{ hr}} Os^{188}$ ; and  $A = 187$ ,  $Au^{187} \xrightarrow{\sim 15 \text{ min}} Pt^{187} \xrightarrow{2.5 \text{ hr}} Ir^{187} \xrightarrow{14 \text{ hr}} Os^{187}$ . II. Two  $180^\circ$  permanent magnet spectrographs with fields of approximately 50 and 100 gauss were constructed and calibrated. These spectrographs have maximum electron radii of curvature of approximately 20 cm; the 50 gauss instrument will record electrons with energies up to approximately 85 kev, and the 100 gauss instrument will record up to approximately 275 kev. The spectrograph and auxiliary equipment are described. The precise energies and the approximate intensities of the Auger electrons emitted in the decay of  $^{131}I$  were determined. The conversion electrons emitted in transitions from the first excited state to the ground state of  $Pu^{238}$  and  $Pu^{240}$ , which are the decay products of  $Cm^{242}$  and  $Cm^{244}$ , respectively, were studied. The low-energy conversion electrons emitted in the alpha decay of  $Am^{241}$  were also investigated, and some transition multipolarities are discussed. (auth)

### 4865

NUCLEAR ELECTRIC QUADRUPOLE MOMENT OF POTASSIUM 39. G. J. Ritter and G. W. Series (Clarendon Lab., Oxford). *Proc. Phys. Soc. (London)* **A68**, 450-1(1955) May.

### 4866

ISOTOPIC SPIN OF LIGHT NUCLEI. A. Baz and Ya. Smorodinskiĭ. *Uspekhi Fiz. Nauk* **55**, 215-64(1955) Feb. (In Russian)

The theory of the isotopic spin of nuclei is discussed, and data on energy levels and isotopic spins of nuclei up to  $A = 50$  are evaluated. 26 references. (G. Y.)

### 4867

ON THE EXPANSION OF THE s SHELL OF  $O^{16}$ . Bernard Jancovici. *Compt. rend.* **240**, 1608-10(1955) Apr. 13. (In French)

A variational calculation is used to estimate the deformation produced in the s shell of  $O^{16}$  by the p nucleons. The radiation from the shell is only 5% higher than that of the  $\alpha$  particle. It is clearly smaller than in a model with a parabolic well. (tr-auth)

### 4868

ON THE CALCULATION OF THE ELECTROSTATIC ENERGY OF LIGHT NUCLEI. Bernard Jancovici. *Compt. rend.* **240**, 1632-4(1955) Apr. 18. (In French)

It is shown that if the s shell of light nuclei is of small dimensions, the average quadrupole radiation from the charge distribution in these nuclei, calculated by the difference in electrostatic energy between mirror nuclei, should be decreased. (tr-auth)

## NUCLEAR REACTORS

### 4869 AD-49318

Naval Postgraduate School, Monterey, Calif.  
THE SWIMMING POOL NUCLEAR REACTOR—ITS CHARACTERISTICS USES, AND RELATIVE MERITS (thesis). John B. Radcliffe, Jr. 1954. 78p.

Design operation, and other aspects of reactor engineering are outlined for swimming pool-type reactors operating at 100-kilowatt and 1-megawatt power levels. Possible

research uses for the reactors are given. A brief technical discussion is included. (C.W.H.)

#### 4870 MMPP-75-1

Michigan. Univ., Ann Arbor. Michigan Memorial-Phoenix Project.

THE NUCLEAR RESEARCH REACTOR AT THE UNIVERSITY OF MICHIGAN. A CONCEPTUAL DESIGN OF THE FACILITY. AN EVALUATION OF THE HAZARDS OF OPERATION AND PROVISIONS FOR LIMITING THESE HAZARDS. William K. Luckow, Russell B. Mesler, and Lawrence C. Widdoes. Nov. 27, 1953. Decl. Feb. 1, 1955. 142p. Contract AT(11-1)-224.

A detailed description of the Michigan Research Reactor is presented, including reactor location and building, reactor design, fuel and waste considerations, administration and operation, testing and experimental programs, safety evaluation, and disaster plan. The pollution climatology of the Ann Arbor area is described. (M.P.G.)

#### 4871

ON THE CHOICE AND DESIGN OF REACTORS. M. N. Saha (Institute of Nuclear Physics, Calcutta, India). Trans. Bose Research Inst. Calcutta 20, 109-26(1955).

### NUCLEAR TRANSFORMATION

#### 4872 UCRL-2955

California. Univ., Berkeley. Radiation Lab. RELATIVE YIELDS OF NITROGEN-17 PRODUCED BY 190-MEV DEUTERON BOMBARDMENT (thesis). Warren W. Chupp. Apr. 13, 1955. 25p. Contract W-7405-eng-48.

Yields of  $N^{17}$  relative to that produced in LiF have been measured in the 190-Mev deflected deuteron and 380-Mev  $\alpha$  beams of the 184-in. synchrocyclotron. The measurements have been performed in all the light elements from O through V, with the exception of Sc and the noble gases. In addition, yields were measured in the separated isotopes of Mg. Inspection of the yields shows clearly their dependence on the neutron excess of the target element,  $T_c = (N-Z)/2$ , and on the total number of nucleons emitted in the reaction. The relative yields are given by the empirical expression  $Y(A, T_c) = \exp[-0.305(A-19) + 2.08(T_c - \frac{1}{2})]$ , well within the limits of experimental error. Rough excitation curves taken on several of the target elements all show a similar behavior. The yields rise monotonically with bombarding energy above threshold and have a tendency toward flatness at the high energies. The thresholds increase gradually with Z. The results were obtained by the detection of the delayed neutrons which are characteristic of  $N^{17}$  and constitute an extensive study of the production of a single nuclear species produced from a variety of target nuclei. Comparisons are made with other types of yield studies performed with neutrons and protons, and the areas of agreement are noted. (auth)

#### 4873 UCRL-2956

California. Univ., Berkeley. Radiation Lab. PHOTODISINTEGRATION OF DEUTERONS AT HIGH ENERGIES (Thesis). Dwight R. Dixon. Mar. 30, 1955. 75p. Contract W-7405-eng-48.

Photodisintegration of deuterons has been investigated by use of the photon beam from the 335-Mev synchrotron at Berkeley. A liquid deuterium target was used. Protons were detected with a telescope consisting of either twelve or thirteen scintillation counters. Pulses from these counters

were presented on an oscilloscope and recorded photographically. The height of the pulse from one of the first counters and the number of subsequent pulses served to identify the protons and determine their energy. Differential cross sections were determined at laboratory angles of  $36^\circ$ ,  $49^\circ$ ,  $75^\circ$ ,  $106^\circ$ , and  $141^\circ$  and at energies ranging from 136 to 293 Mev, and curves of the form  $d\sigma/d\Omega' = A + B \cos \theta' + C \cos^2 \theta'$  were fitted to the experimental points at various energies. The ratio B/A decreased from 0.46 at 143 Mev to 0.16 at 293 Mev. The ratio C/A was of the order of  $-0.4$ . Total cross sections of about  $70 \mu b$  were obtained, and there was some indication of a maximum in the total cross section in the vicinity of 250 Mev. A comparison is made with the results of similar experiments at other laboratories. Some suggested interpretations of the observed results are discussed briefly. (auth)

#### 4874

ANGULAR DISTRIBUTIONS AND ANGULAR CORRELATIONS IN THE REACTION  $^{23}\text{Na}(p, \gamma)^{24}\text{Mg}$ . P. J. Grant, J. G. Rutherglen, F. C. Flack, and G. W. Hutchinson (Univ. of Glasgow). Proc. Phys. Soc. (London) A68, 369-76(1955) May.

The angular distributions and angular correlations of the more intense  $\gamma$ -ray components in the reaction  $\text{Na}^{23}(p, \gamma)\text{Mg}^{24}$  have been determined at four resonances. Those at proton energies of 310, 515, and 679 kev are assigned  $J = 2^-$ ,  $J = 1^+$ , and  $J = 3^+$  formed by p-, s-, and d-wave protons respectively. The resonance at 593 kev has  $J = 2^-$  formed by p-wave protons and is therefore distinct from that in the  $(p, \alpha)$  reaction at this energy. The level in  $\text{Mg}^{24}$  at 4.24 Mev is assigned  $J = 2^+$  and that 5.26 Mev  $J = 3$ , probably with odd parity. (auth)

#### 4875

ANGULAR DISTRIBUTIONS FROM (d,n) REACTIONS AT 0.86 MEV DEUTERON ENERGY. L. L. Green, J. P. Scanlon, and J. C. Willmott (Univ. of Liverpool). Proc. Phys. Soc. (London) A68, 386-92(1955) May.

The angular distributions of neutron groups from the reactions  $\text{Be}^9(d, n)\text{B}^{10}$  and  $\text{C}^{13}(d, n)^{14}\text{N}$  have been measured for a deuteron energy of 0.86 Mev. The excitation energies of the first few excited states of  $\text{B}^{10}$  and  $\text{N}^{14}$  have been measured and are in good agreement with previous measurements. The angular distributions have been analyzed in terms of both compound nucleus and stripping interactions. Only the fourth excited state of  $\text{B}^{10}$  and the third excited state of  $\text{N}^{14}$  were found to be formed to a large extent by deuteron stripping. (auth)

#### 4876

AN INVESTIGATION OF  $^7\text{Li}(d, n)^8\text{Be}$  AND  $^{11}\text{B}(d, n)^{12}\text{C}$  NUCLEAR REACTIONS. M. A. Ihsan (Univ. of Liverpool). Proc. Phys. Soc. (London) A68, 393-7(1955) May.

The energy levels of  $\text{Be}^8$  and  $\text{C}^{12}$  have been studied by means of the  $(d, n)$  reaction using deuterons of energy 686 kev. Evidence of levels in  $\text{Be}^8$  was found at 2.98 and 7.53 Mev. Investigation of energy levels of  $\text{C}^{12}$  has shown energy peaks at 4.40, 7.63, and 9.72 Mev, respectively. The angular distribution of neutrons from the  $\text{B}^{11}(d, n)\text{C}^{12}$  reaction also has been investigated. (auth)

#### 4877

THE YIELD OF  $^7\text{Li}(p, n)^7\text{Be}$  NEUTRONS FOR PROTON ENERGIES BETWEEN 2.5 AND 2.9 MEV. R. Batchelor (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 452-3(1955) May.



## PARTICLE ACCELERATORS

**4878** AERE-GP/M-170

Gt. Brit. Atomic Energy Research Establishment,  
Harwell, Berks, England.

STATISTICAL ANALYSIS OF OPTICAL ALIGNMENT IN A  
LINEAR ACCELERATOR. L. B. Mullett. Dec. 17, 1954.  
10p.

In satisfying the stringent conditions of alignment to an axis in a linear accelerator employing alternating gradient focusing, optical methods are an obvious solution. The probability relationships are developed for the optical method which is being evolved for the 600-Mev proton linear accelerator. (auth)

**4879**

THE BREAK-UP OF NEGATIVE IONS IN THE CYCLOTRON  
J. H. Fremlin and V. M. Spiers (Univ. of Birmingham).  
Proc. Phys. Soc. (London) A68, 398-403(1955) May.

A pinhole camera at the periphery of the cyclotron was used to record neutral products of dissociation of molecular ions accelerated to various radii. From the numbers of particles reaching different parts of a C2 nuclear plate in the camera, the attenuation of the accelerated ions due to collisions with residual air molecules could be deduced. This was compared with the attenuation for  $H_2^+$  ions observed in a similar way. The cross section for dissociation of these by air is known, so the cross sections for other ions could be determined. At a velocity corresponding to 1 Mev per nucleon, the cross sections for  $D^-$  and  $HeH^+$  were found to be respectively  $7.6 \times 10^{-16} \text{ cm}^2$  and  $1.0 \times 10^{-14} \text{ cm}^2$  with an accuracy to about 30%. (auth)

**4880**

LATERAL STABILIZATION OF THE ION BEAM IN A LIN-  
EAR ACCELERATOR WITH ELECTROSTATIC GRID  
LENSES. Michel-Yves Bernard. Compt. rend. 240, 1636-8  
(1955) Apr. 18. (In French)

It is suggested that the divergence of an ion beam in an Alvarez linear accelerator may be compensated by grid lenses, placed in the middle of movable tubes. The grid is therefore removed from the destructive h-f field. (tr-auth)

**4881**

THE 15-MEV LINEAR ACCELERATOR AT ST. BAR-  
THOLOMEW'S HOSPITAL. J. Rotblat. Nature 175, 745-7  
(1955) Apr. 30.

The electron linear accelerator is of the travelling-wave type and will be used for medical research. The accelerator consists essentially of two parts, each containing three one-meter sections of corrugated wave guide and a feed-back system. The r-f power is derived from one magnetron and is split to supply the same amount of power to each part. The design of the machine is very similar to the one described by Bareford and Kelliher (Philips Tech. Rev. 15, 1(1953)). (L.T.W.)

**4882**

A NEW LINEAR ACCELERATOR FOR BRITISH HOSPITAL.  
A 15-MEV MACHINE FOR ST. BARTHOLOMEW'S,  
LONDON. Atomica 6, 139-43(1955) May.

## RADIATION ABSORPTION AND SCATTERING

**4883** AERE-T/M-120

Gt. Brit. Atomic Energy Research Establishment,  
Harwell, Berks, England.

THE ENERGY SPECTRUM OF NEUTRONS REFLECTED

FROM A MODERATOR. K. T. Spinney. Jan. 1955. 15p.

Analytic expressions are derived for the energy spectrum of neutrons emerging from a moderating medium which is being irradiated by fast neutrons. Some examples are given for the case of concrete. (auth)

**4884** CRLR-479

Chemical and Radiological Labs., Army Chemical Center,  
Md.

SOME USEFUL INTEGRAL FORMULAS FOR THE INITIAL  
REDUCTION OF THE TRANSPORT EQUATION. (SPECIAL  
REPORT). Richard Liboff. Mar. 31, 1955. 18p.

**4885** UCRL-2975

California. Univ., Berkeley. Radiation Lab.

ELASTIC SCATTERING OF HIGH-ENERGY POLARIZED  
PROTONS BY COMPLEX NUCLEI (thesis). Robert D.  
Tripp. Apr. 29, 1955. 57p. Contract W-7405-Eng-48.

The differential cross section and polarization of protons elastically scattered from various elements has been measured as a function of scattering angle. Helium, carbon, calcium, iron, and tantalum were measured with a 313-Mev 76%-polarized proton beam, while for carbon and aluminum a 288-Mev 67%-polarized beam was used. Diffraction effects were observed in the cross sections, and associated fluctuations of polarization with scattering angle were seen for elements heavier than carbon. Triple-scattering experiments were performed on aluminum and carbon to measure the spin-rotation functions and depolarization functions for these elements. Calculations using a complex central potential and spin-orbit interaction give qualitative agreement with experiment. (auth)

**4886** AERE-Lib/Trans-541

ELASTIC SCATTERING OF PROTONS BY PROTONS AT AN  
ENERGY OF 660 MEV. N. P. Bogachev and I. K. Vzorov.  
Translated by J. B. Sykes from Doklady Akad. Nauk S.S.S.R.  
99, 931-3(1934). 4p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-2491.

**4887** AERE-Lib/Trans-542

ELASTIC SCATTERING OF NEUTRONS OF ENERGY 380  
MEV BY PROTONS. V. P. Dzhelepov and Yu. M. Kazari-  
nov. Translated by J. B. Sykes from Doklady Akad. Nauk  
S.S.S.R. 99, 939-42(1954). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-2492.

**4888** AERE-Lib/Trans-543

ELASTIC SCATTERING OF NEUTRONS BY NEUTRONS AT  
AN ENERGY OF 300 MEV. V. P. Dzhelepov, B. M. Golovin,  
and V. I. Satarov. Translated by J. B. Sykes from Doklady  
Akad. Nauk S.S.S.R. 99, 943-6(1954). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-2932.

**4889** AERE-Lib/Trans-544

ELASTIC SCATTERING OF PROTONS BY PROTONS AT AN  
ENERGY OF 460 MEV. M. G. Meshcheryakov, N. P.  
Bogachev, B. S. Neganov, and E. V. Piskarev. Translated  
by J. B. Sykes from Doklady Akad. Nauk S.S.S.R. 99, 955-8  
(1954). 4p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-2934.

**4890** AERE-Lib/Trans-545

THE ANOMALOUS VARIATION OF THE CROSS-SECTION  
FOR ELASTIC SCATTERING OF PROTONS BY PROTONS



IN THE RANGE 460 TO 660 MEV. M. G. Meshcheryakov, B. S. Neganov, L. M. Soroko, and I. K. Vzorov. Translated by J. B. Sykes from *Doklady Akad. Nauk S.S.S.R.* 99, 959-61(1954). 4p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-2493.

**4891** AERE-Lib/Trans-546

THE SCATTERING OF PROTONS OF ENERGY 460 TO 660 MEV BY PROTONS. Ya. M. Selektor, S. Ya. Nikitin, E. G. Bogomolov, and S. M. Zombkovskii. Translated by J. B. Sykes from *Doklady Akad. Nauk S.S.S.R.* 99, 967-9(1954). 3p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-2935.

**4892**

POTENTIAL ENERGY OF A CHARGED PARTICLE MOVING IN AN ANISOTROPIC MEDIUM. A. G. Sitenko and M. I. Kaganov (Physico-Technical Inst.). *Doklady Akad. Nauk S. S. S. R.* 100, 681-3(1955) Feb. 1 (In Russian)

**4893**

ELASTIC SCATTERING OF POLARIZED PROTONS FROM COMPLEX NUCLEI. J. M. Dickson, B. Rose, and D. C. Salter (Atomic Energy Research Establishment, Harwell, Berks, England). *Proc. Phys. Soc. (London)* A68, 361-8 (1955) May.

The degree of polarization obtained when approximately 130-Mev protons are scattered from Be, C, Al, Fe, Ag, Cd, Bi, and U has been studied as a function of the laboratory scattering angle from 10 to 45°. Irregularities in the patterns so obtained may be associated with the diffraction patterns of the elements concerned. The degree of polarization from Be and C has been found to fall rapidly as the proton energy is reduced below 130 Mev. (auth)

**4894**

STUDY OF THE ANGULAR DISTRIBUTION OF  $O^{16}(d,p)O^{17*}$  PROTONS NEAR A DEUTERON CAPTURE RESONANCE. A. Berthelot, R. Cohen, E. Cotton, H. Faraggi, T. Grjebine, A. Leveque, V. Naggiar, M. Roclawski-Conjeaud, and D. Szeinszneider. *J. phys. radium* 16, 241-52(1955) Apr. (In French)

A study of the proton angular distributions emitted by the  $O^{16}(d,p)O^{17*}$  reaction (875-kev level) was made by a photographic method for 7 different deuteron energies between 1.66 and 2.20 Mev. The deuterons were obtained from the Saclay electrostatic generator. An analysis of the results shows that the angular distribution in the forward direction is, for all energies, in good agreement with stripping theory ( $l = 0$ ), corresponding to the maximum of deuteron resonance capture at 2.1 Mev. Further, the differential scattering cross section at 7° goes through a maximum for this resonance energy. (tr-auth)

**4895**

ON THE DETERMINATION OF MULTIPLE SCATTERING FROM IONIZATION TRACKS. H. Olsen, H. Wergeland, and H. Øveraas. *Kgl. Norske Videnskab. Selskabs, Forh.* 26, 36-40(1953). (In English)

Several methods of measurement are outlined for the determination of multiple scattering from ionization tracks. Correlations are made to theoretical predictions of scattering. (C.W.H.)

RADIATION EFFECTS

**4896** AECD-3652

North American Aviation, Inc., Downey, Calif.

THE EFFECT OF RADIATION DAMAGE ON THE THER-

MAL CONDUCTIVITY OF GRAPHITE. Alan W. Smith. [1954?] Decl. Mar. 9, 1955. 8p. Contract [AT-11-1-GEN-8].

The thermal conductivity of types AGOT-KC and AWG coke graphites and SA-25 lampblack graphite are given for several neutron irradiations at 30 to 50°C where the integrated flux of neutrons with energies greater than 0.5 Mev is noted. (L.T.W.)

RADIOACTIVITY

**4897**

DIRECTIONAL CORRELATION OF THE  $Ti^{46}$  GAMMA-GAMMA CASCADE. Takeo Hayashi Mitsuhiro Kawamura, and Atsushi Aoki (Saikyo Univ., Kyoto, Japan). *J. Phys. Soc. Japan* 10, 334-6(1955) May.

The directional correlation of successive gamma rays from  $Ti^{46}$  was measured using RCA 5819 photomultiplier tubes with NaI(Tl) scintillation crystals as the detectors. The measurements were made by counting more than 50,000 genuine coincidence counts at each angle. It was found that the successive gamma rays were both quadrupole, and the spins of the ground, 1st, and 2nd excited state should be 0, 2, and 4, respectively. (auth)

**4898**

HALF LIFE OF  $Ti^{204}$ . Jacques Tobailem and Jean Robert. *J. phys. radium* 16, 340-1(1955) Apr. (In French)

Ionization chamber techniques were used on a purified sample ( $Ti(NO_3)_3$  in  $HNO_3$ ) for a 45-day period. The results yielded a value of  $T = 4.26 \pm 0.06$  yr, corresponding to a radioactive constant  $\lambda = (5.16 \pm 0.07) \times 10^{-9}/\text{sec}$ . (K.S)

**4899**

STUDY OF  $\gamma$  AND X RADIATION FROM ACTINIUM. E. Bouchez, A. Michalowicz, M. Riou, and J. Teillac. *J. phys. radium* 16, 344-5(1955) Apr. (In French)

**4900**

STUDY OF THE  $\beta^-$  SPECTRUM COMPONENTS OF  $Rb^{86}_{37}$ . Jeanne Laberrigue-Grolow and M. Michel Lederer. *J. phys. radium* 16, 346-7(1955) Apr. (In French)

SPECTROSCOPY

**4901**

HYPERFINE STRUCTURE OF THE SPECTRUM OF Mn I. Kiyoshi Murakawa (Institute of Science and Technology, Tokyo). *J. Phys. Soc. Japan* 10, 336-8(1955) May.

The hyperfine structure of the lines Mn I  $\lambda 5432$ ,  $\lambda 5395$ , and  $\lambda 4034$  was measured, and the quadrupole moment of  $Mn^{55}$  was calculated to be  $(0.4 \pm 0.2) \times 10^{-24} \text{ cm}^2$ . (auth)

**4902**

BETA- AND GAMMA-RAY SPECTROSCOPY. Kai Siegbahn, ed. New York, Interscience Publishers, Inc., 1955 959p. \$20.00.

**4903**

$\gamma$ -RADIATION FROM CHARGED PARTICLE REACTIONS. D. E. Alburger (Brookhaven National Lab., Upton, N. Y. Chap. 24 (pp. 767-94) in "Beta- and Gamma-Ray Spectroscopy", Kai Siegbahn, ed. New York, Interscience Publishers, Inc., 1955. 959p. \$20.00.

The emission of  $\gamma$  lines by Coulomb excitation from bombardment by charged particles is discussed theoretically. Spectrometric techniques associated with this phenomenon are also considered. (K. S.)

**4904**

EMISSIONS NEAR ABSORPTION DISCONTINUITIES IN THE



**L REGION OF THE X-RAY SPECTRA OF RARE EARTHS**  
 Paul Sakellaris (Laboratoire de Chimie Physique, Paris).  
J. phys. radium **16**, 271-3(1955) Apr. (In French)

X-ray emissions near the L absorption discontinuities in rare earth elements, involving 4f, 5p, and 5d, electrons, are of particular interest. A systematic study of these lines is reported for Eu, Gd, Tb, Ho, and Tm oxides in the 3 valence state. The total  $\gamma_4 \gamma_4'$  emission ( $L_{II} 0_{II, III}$ ) appears complex, with a marked widening near the short wavelengths. Several secondary maxima and minima are observed whose frequency and energy in relation to the principal  $\gamma_4 \gamma_4'$  are determined. The results, together with those already known about the M spectra of these elements, indicate a coincidence between the  $\gamma_8(L_{II} 0_{IV})$  and  $\gamma_8'(L_{II} N_{VI, VII})$  emissions on one hand and the  $\beta_5(L_{III} 0_{IV, V})$  and  $\beta_5'(L_{III} N_{VI, VII})$  emissions on the other. (tr-auth)

#### 4905

**X-RAY EMISSION SPECTROSCOPY WITH ELECTRON EXCITATION COVERING ELEMENTS  ${}_4\text{Be}$ - ${}_{92}\text{U}$ .** G. L. MacDonald and M. G. Harwood (Philips Electrical Ltd., Surrey, England). Brit. J. Appl. Phys. **6**, 168-72(1955) May.

A plane glass optical diffraction grating has been used to disperse characteristic x rays of wavelengths 5 to 200 Å produced by electron bombardment of materials. Advantages of an electron as opposed to an x-ray source for the analytical determination of the elements by x-ray spectroscopy are

discussed. It is shown that almost any element throughout the periodic system can be detected with one photographic exposure, using K, L, M, and N radiations. Light and heavy elements are recorded with equal facility. X-ray spectroscopy and electron diffraction have been combined to produce simultaneous elementary and compound analysis. The particular advantages of the method for the identification of surface films are noted. (auth)

#### THEORETICAL PHYSICS

#### 4906 AEC-tr-2140

**ADIABATIC FORM OF PERTURBATION THEORY IN THE PROBLEM OF PARTICLE INTERACTION WITH A QUANTUM FIELD.** S. V. Tyablikov. Translated from Zhur. Eksptl'. i Teoret. Fiz. **21**, 377-88(1951) 18p. Available from Morris D. Friedman ([Trans. No.] D193568), West Concord, Mass.

A new form of the adiabatic perturbation theory is explained in the problem of particle interaction with quantum fields. As an example, the Hamiltonian of an electron in an ionic crystal is considered. (auth)

#### 4907

**PROBLEMS IN THE QUANTUM THEORY OF FIELDS.** N. N. Bogolyubov and D. V. Shirkov. Uspekhi Fiz. Nauk **55**, 149-214(1955) Feb. (In Russian)

